NIDEK

OPHTHALMIC YAG LASER SYSTEM

Model YC-1600

SERVICE MANUAL

NIDEK CO., LTD.

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§1 INTRODUCTION

1.1 Before using this manual

- This service manual is for the OPHTHALMIC YAG LASER SYSTEM YC-1600.
- Be sure to use this manual after understanding the operator's manual for the OPHTHALMIC YAG LASER SYSTEM YC-1600 thoroughly.
- This manual is subject to change without notice for improvement. Since the Technical Bulletin will be released every time significant changes are made to the system, refer to the Technical Bulletin together with this manual.

1.2 Before repairing

- Be sure not to lose or drop the removed screws inside the system.
- Apply a threadlocker to the screws which have been loosened and tightened again.
- Refer to the wiring diagram of the YC-1600 when repairing (see 7.1).

1.3 Handling and repairing of the laser head

- Be sure to turn OFF the power of the system when handling the laser head.
- Be sure to return the laser head to NIDEK for repair. Never disassemble, adjust and repair the laser head.
  NIDEK assumes no responsibility if the laser head is disassembled, adjusted and repaired.

1.4 Handling and repairing of the board and wiring

- Be sure to turn OFF the power of the system when handling and repairing the board and wiring.

[WARNING]
Since Nd:YAG laser is an invisible infrared ray, it may cause the hazardous exposure to radiation if the system is improperly handled and operated.

[CAUTION]
Be sure not to expose yourself to the laser beam at a place where the laser beam passes through or is emitted when handling and repairing.

[CAUTION]
Be sure to use the safety goggles for the Nd:YAG laser.

[CAUTION]
Never look straight at the Nd:YAG laser even if the safety goggles are used.

[CAUTION]
Never touch the optical parts such as mirrors and lens directly.

[CAUTION]
Never emit the laser beam to the skin.

[CAUTION]
Pay attention not to get an electric shock when unavoidably opening covers to check or repair the electrical parts.

§2 CAUTIONS

2.1 Cautions in laser emission

- Never emit the laser beam to personnel or things.
- Never touch the high voltage part (shown with ⚡ mark) when emitting the laser beam since there is a fear of an electric shock.
- Be sure not to drop metallic parts such as tools and screws into the laser system.

2.2 Handling of the laser head

- Never disassemble or repair the laser head.
  Return the laser head to NIDEK if the repair is necessary.

2.3 Boards for repair

- The IC8 (EEPROM) on the MASTER BOARD which is supplied by NIDEK has already been placed in the initial state. The setting values memorized in each EEPROM become optimum for each system's performance. As a result, the setting values may be varied according to each system.
  If using a new board, remove the IC8 (EEPROM) from the old one and attach it to a new one.

2.4 Cautions in checking connectors

- Visually check the connecting condition of connectors.
  If the connector is almost disconnected, securely reconnect it.
- Verify the conditions of the contact pins and contacts.
  - Cleaning of the contact pins
    Clean the contacts with a spray which restores electrical continuity to them when dust or oil makes them dirty.
  - Verify the condition of the contact pins and contacts.
    Disconnect the connectors and verify each cord by pulling a cord with the force approx. 1 kgf.
    If the contact pin is removed, raise the hook of the pin using the precise screwdriver, and insert it into the connector.

2.5 Cautions in disconnecting cords

- If the heat-shrinkable tube covers the cord, remove it using nippers or knife.
- Use the soldering iron to remove the soldered parts.
- Remove the old solder adhered to the cord or terminal with the soldering iron.

2.6 Cautions in soldering cords

- If the cord was covered by the heat-shrinkable tube, run the cord through the tube.
- Solder the cords to bundle them before soldering the cord.
- Put the heat-shrinkable tube on the soldered part and constrict it using a heat gun.

2.7 Cautions in using the energy meter for the YAG laser

- According to the energy meter to be used, the necessity of the dispersion lens, which is attached to the objective lens at the time of the energy measurement, is varied.
  Refer to the table below when measuring the energy.

Energy meter	Dispersion lens
MODEL-365	Necessary
MODEL PHDX50	Unnecessary

- There is a fear that the detector of the energy meter is damaged if the excessive energy density is applied to the photoreceptor of the detector.
  Be sure to maximize the spot size of the aiming beam on the photoreceptor as possible so that the YAG laser never come into focus on the photoreceptor.

§3 TROUBLESHOOTING

Plug the power cord to the wall outlet.

↓

Does the pilot lamp light? — N → 4.1 The pilot lamp does not light

↓ Y

Insert the key and turn to the ON (⊙) position.

↓

Do the fixation lamp and backlight of the control panel light? — N →
- 4.2 Both fixation lamp and backlight of the control panel do not light
- 4.3 Only fixation lamp does not light
- 4.4 Only backlight of the control panel does not light

↓ Y

Does the error display appear? — Y → 4.5 The error display appears

↓ N

Remove the cap and insert the focusing rod. Is the illumination light projected on the focusing rod? — N → 4.6 The illumination light is not projected

↓ Y

Adjust the dioptric power of the eyepieces.

↓

Adjust the PD of the microscope.

↓

Is the condition of the optical system of the microscope normal? — N →
- 4.7 The focusing rod looks like shifting when the PD is adjusted
- 4.8 The center of illumination light is shifted from the center of Microscopic visual field when the magnification is 10×
- 4.9 The focusing rod cannot be seen clearly

↓ Y

Is the condition of the illumination normal? — N →
- 4.10 There are some spots in the illumination light
- 4.11 The illumination light is not focused on the focusing rod
- 4.12 The position of illumination light on the focusing rod is not normal
- 4.13 The illumination light does not go out even if the Brightness control is turned fully counterclockwise

↓ Y

Is the condition of the slit normal?
- N → 4.14 The slit image tilts when turning it to the vertical position
  4.15 The slit does not fully close or open
  4.16 The position where the slit closes shifts from the center
- Y ↓

Is the movement of the slit lamp normal?
- N → 4.17 Coarse movement to back and forth is not smooth
  4.18 Coarse movement to right and left is not smooth
  4.19 Fine movement to back and forth, and to right and left is not smooth
  4.20 Vertical movement is not smooth
- Y ↓

Reduce the light amount of the slit lamp.

↓

Can the aiming beam be seen?
- N → 4.21 Aiming beam is not emitted
- Y ↓

Remove the focusing rod and attach the cap.

↓

Stick the burn paper to the head rest.

↓

Turn the Energy control to set the output energy to minimum.

↓

Turn the YAG Focus shift control to “0” position.

↓

Do the STATUS indicator for STANDBY mode go off and the one for READY mode light when the STATUS switch is pressed?
- N → 4.22 The STATUS indicator for READY mode does not light
- Y ↓

Is the YAG laser beam emitted normally when the trigger switch is pressed?
- N → 4.5 The error display appears
  4.23 The position of burnt pattern is not same to the projected position of the aiming beam
  4.24 There is an unevenness in the burnt pattern
- Y ↓

Can the setting of the number of pulses be changed when the Burst switch is pressed?
N → 4.25 Setting of the number of pulses can not be changed

Y

Is the counter reset to “0” when the Reset switch is pressed?
N → 4.26 Counter display cannot be reset to “0”

Y

Is the energy of the emitted YAG laser beam normal?
N → 4.27 The measured energy of YAG laser beam is not normal

Y

Does the system stop when the Emergency stop switch is pressed?
N → 4.28 The system does not stop with the Emergency stop switch

Y

Turn the key switch to OFF (◯) position and pull out the key.

End

§4 SUB TROUBLESHOOTING

4.1 The pilot lamp does not light

This trouble may be caused by the break of fuses in the switch box, failure of the switching power supply, and connection failure of connectors.

Is there continuity in F1 and F2 fuses in the switch box?
(See 5.2.)
→ N: Replace fuses. (See 5.2.)

↓ Y

Is the required voltage applied to the wall outlet?
(See 5.3.)
→ N: Secure the required voltage. (See 5.3.)

↓ Y

Is the voltage between 1(-) and 2 (+) of P2 in the switching power supply DC +12V?
→ N: Replace the switching power supply. (See 5.8.)

↓ Y

Is the voltage between 1 (+) and 2 (-) of P501 on the key switch board DC +12V?
→ N: Connection failure of the cable of P501 or connector. Check the continuity and repair the failed part.

↓ Y

Is the voltage between 5 (+) and 6 (-) of P502 on the key switch board DC +12V?
→ N: Connection failure inside the key switch board.
Replace the key switch board with a new one. (See 5.4.)

↓ Y

Failure of the pilot lamp.
Replace it with a new one.
(See 5.5.)

4.2 Both fixation lamp and backlight of the control panel do not light

This trouble may be caused by the connection failure of connectors.

Is there no continuity between 2nd and 4th/5th pin on the key switch when the key switch is turned OFF?
Is there continuity between 2nd and 4th/5th pin on the key switch when the key switch is turned ON?

N → Failure of the key switch.
Replace the key switch board with a new one.
(See 5.4.)

↓ Y

Is the Emergency stop switch normal?

N → Replace the Emergency stop switch with a new one.
(See 5.6.)

↓ Y

Disconnect P3 of the remote connector.
Is there continuity between 3rd and 4th pin of P3?

N → Connection failure between 3rd and 4th pins of P3 of the remote connector.
Repair the failed part.

↓ Y

Reconnect connectors P501, P502, and P503 on the key switch board and P3 of the remote connector.

4.3 Only fixation lamp does not light

This trouble may be caused by the connection failure of connectors.

Is the voltage between 1 (+) and 2 (-) of P503 on the key switch board DC +12V?
- N → Connection failure inside the key switch board. Replace the key switch board with a new one. (See 5.4.)
- Y ↓

Remove the fixation lamp ASSY. Is the voltage between 1 (+) and 2 (-) of P1 DC +12V?
- N → Connection failure of the cable between P503 and J13, between P13 and P1, or connectors. Check the continuity and repair the failed part.
- Y ↓

Replace the fixation lamp ASSY. (See 5.7.)

4.4 Only backlight of the control panel does not light

This trouble may be caused by the connection failure of connectors or failure of the master board.

Are the following connections proper?
- P113 and P106 on the master board
- J201 on the display board, P501 on the key switch board
- J5 of the external connector

N → Reconnect the connectors.

Y ↓

Is the voltage between 1 (+) and 3 (-) of P113 on the master board DC +12V?
- N → Break in the cable or connection failure between PJ5 on the key switch board and PJ113 on the master board. Check the continuity and repair the failed part.
- Y ↓

Is the voltage between 1 (+) and 2 (-) of P110 on the master board DC +5V?
- N → Replace the master board with a new one. (See 5.9.)
- Y ↓

Replace the display board ASSY with a new one. (See 5.11.)

4.5 The error display appears

4.5.1 Error 1 appears

Error 1 appears when the temperature inside the YAG laser head becomes 45 ºC or more.

Turn the key switch to the OFF position and remove the right and left covers.
Set it aside for 30 minutes for cooling.

↓

Is the resistance across TS1 on the master board infinity? —Y→ Failure of TS1.
Replace the master board with a new one.
(See 5.9.)

↓ N

Replace the master board with a new one.
(See 5.9.)

4.5.2 Error 4 appears

Error 4 appears when the malfunction occurs to the contents of EEPROM.

Initialize the EEPROM.
(See 9.2.)

↓

Reset the followings;
- Aiming energy
- PFN voltage
- Focus of the YAG laser
- YAG laser energy

(See 6.3.6, 6.4.3, 6.4.6, 6.4.10.)

4.5.3 Error 5 appears

Error 5 appears when the YAG shutter does not open or close automatically.
The cause may be the failure of the detection sensor of the YAG shutter.

Does the YAG shutter open when the system is in the READY state and close in the STANDBY state?
N → Failure of the rotary solenoid.
Replace the YAG shutter ASSY with a new one.
(See 5.17.)

↓ Y

Is the YAG shutter caught in cables?
Y → Repair the part where the YAG shutter plate is caught in.

↓ N

Are the voltage between 5 (+) and 7 (-) of P102 on the master board DC +5V, and between 6 (+) and 7 (-) DC +0V when the shutter close?
N → Failure of the IC1 on the master board.
Replace the master board with a new one.
(See 5.9.)

↓ Y

Is the detection sensor (photo-interrupter) normal?
(See 6.4.1.)
N → Failure of the detection sensor.
Replace the YAG shutter ASSY with a new one.
(See 5.17.)

↓ Y

Is the rotary solenoid fixed firmly?
Y → Fix the rotary solenoid.
(Refer to 5.17.)

↓ N

Adjust the YAG shutter ASSY.
(See 6.4.1.)

4.5.4 Error 7 appears

Error 7 appears in the case where the aiming shutter does not open automatically when the aiming laser is ON or it does not close when the aiming laser is OFF.
The cause may be the failure of the detection sensor of the aiming shutter or the solenoid for the aiming shutter.

• The aiming shutter does not open automatically when the aiming laser is ON.

Is the aiming shutter plate placed in the open position?

N → Is the voltage between 1 (+) and 2 (-) of P103 on the master board DC +10V or more?

N → Failure of the IC2 on the master board.
Replace the master board with a new one.
(See 5.9.)

Y → Failure of the solenoid.
Replace the aiming shutter ASSY with a new one.
(See 5.18.)

Y → Is the voltage between 4 (+) and 7 (-) of P103 on the master board DC 0V?

N → Adjust the position of the detection sensor (photo-interrupter).
(See 6.3.1.)

Y → Failure of the IC1 on the master board.
Replace the master board with a new one.
(Refer 5.9.)

• The aiming shutter does not close automatically when the aiming laser is OFF.

Is the aiming shutter plate placed in the close position?

N → Is the voltage between 1 (+) and 2 (-) of P103 on the master board DC 0V or more?

N ↓ Failure of the IC2 on the master board.
Replace the master board with a new one.
(See 5.9.)

Y ↓ Failure of the rotary solenoid.
Replace the aiming shutter ASSY with a new one.
(See 5.18.)

Y ↓ Is the voltage between 4 (+) and 7 (-) of P103 on the master board DC +5V?

N → Adjust the position of the detection sensor (photo-interrupter).
(See 6.3.1.)

Y ↓ Failure of the IC1 on the master board.
Replace the master board with a new one.
(Refer 5.9.)

4.5.5 Error 10 appears

Error 10 appears when the number of emitted YAG laser beams is less than the set number of pulses.
The cause may be that the PFN voltage is too low.

Set 7 of the SW1 on display board ASSY to OFF (upper position). The number of pulses appears on the counter display.

↓

Emit the YAG laser 10 shots.

↓

Is “4” (number of pulses) displayed on the pulse number display more than 8 times?

Y → Failure of the master board.
Replace the master board with a new one.
(See 5.9.)

N

↓

Adjust the PFN voltage.
(See 6.4.3.)

↓

Does Error 10 appear?

Y → If “4” is not displayed more than 8 times in 10 times even though the PFN voltage is raised to 440V (max.), the YAG laser head fails.
Replace the YAG laser unit with a new one.
(See 5.12.)

N

↓

End

4.5.6 Error 12 appears

Error 12 appears when the number of pulses of the YAG laser is over the intended number.

Replace the YL power supply board with a new one.
(See 5.20.)

4.5.7 Error 13 appears

Error 13 appears when the YAG laser is emitted even though the trigger switch is not pressed.

The cause may be the malfunction by the noise. Use the system away from the devices which may cause the noise.

4.5.8 Error 14 appears

Error 14 appears when the flash lamp does not light.

Remove the covers.
Does the flash lamp light when the trigger switch is ON or at the time of the test fire?

Y → Failure of the master board.
Replace the master board with a new one.
(See 5.9.)

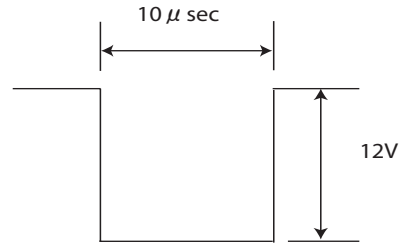
N ↓

Is the PFN voltage proper?
(See 6.4.3.)

N → Adjust the PFN voltage.
(See 6.4.3.)

Y ↓

Check the signal of TP3 (TRIG OUT) on the YL board at the time of the trigger.



Signal at the time of the trigger is ON.

↓

Is the signal of TP3 (TRIG OUT) normal?

N → Is the wiring between 4th pin of P1 on the YL board and 4th pin of P112 on the master board proper?

N → Repair the wiring.

Y ↓

Failure of the YAG laser unit.
Replace the YAG laser unit with a new one.
(See 5.12.)

Y ↓

Failure of the master board.
Replace the master board with a new one.
(See 5.9.)

N ↓

Is the problem solved?

Y → End

N ↓

Failure of the YL power supply board.
Replace the YL power supply board with a new one.
(See 5.20.)

4.5.9 Error 15 appears

Error 15 appears when the output energy of the YAG laser beam is not within ±20 % of the rating.

Measure the output energy of the YAG laser beam.
Is the variability within ±20 % of the rating?

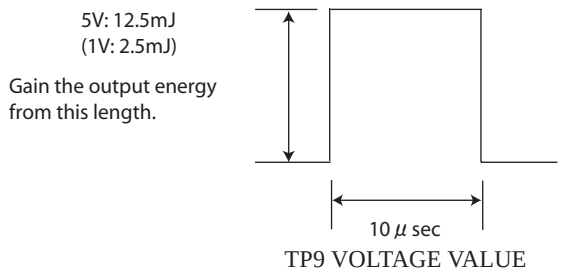
N → Failure of the YAG laser unit.
Replace the YAG laser unit with a new one.
(See 5.12.)

↓ Y

Measure the master board TP9 with the oscilloscope. Is the ratio between the voltage of TP9 and the energy indication 1V : 2.5mJ?

Y → Failure of the master board.
Replace the master board with a new one.
(See 5.9.)

↓ N



TP9 VOLTAGE VALUE

Are the wirings of 4th pin of P110 on the master board and that of the sample board proper?

Y → Failure of the sample board.
Replace the energy monitor ASSY with a new one.
(See 5.13.)

↓ N

Repair the wiring.

4.5.10 Error 30 appears

Error 30 appears when the power supply for the laser head is faulty.

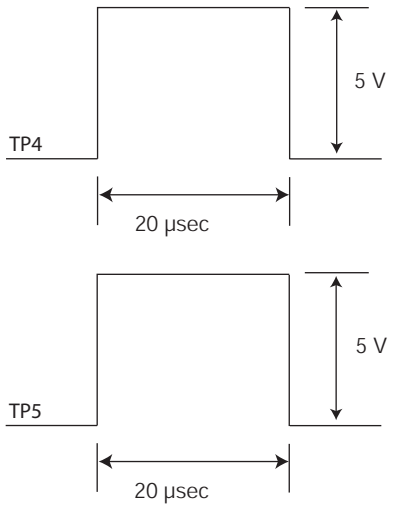
Does the voltage of TP5 on the YL board change from LOW to HIGH when the trigger switch is pressed?
→ N: Is the wiring between 6 pin of J1 and 6th pin of P112 on the YL board proper?
→ Y: Failure of the master board. Replace the master board with a new one. (See 5.9.)
→ N: Repair the wiring.

↓ Y

Does the voltage of TP4 on the YL power supply board change from LOW to HIGH when the trigger switch is pressed?
→ Y: Is the wiring between 5th pin of J1 and 5th pin of P112 on the YL board proper?
→ Y: Failure of the master board. Replace the master board with a new one. (See 5.9.)
→ N: Repair the wiring.

↓ N

Failure of the YL power supply board.
Replace the YL power supply board with a new one.
(See 5.20.)



Waveform of TP4 and 5 when the trigger is ON.

4.5.11 Error 31 appears

Error 31 appears when the PFN voltage is faulty.

Compare the setting value of the PFN voltage at parameter 10 with that of the PFN voltage (between 1st (+) and 5th (-) pins of J2 on the YL board).
Is the difference within 20V?
(See 6.4.3)
[CAUTION] Pay attention to the handling since the voltage becomes 440V±10V at maximum.

Y → Is the wiring between the YL power supply board and master board proper?

Y → Failure of the master board.
Replace the master board with a new one.
(See 5.9.)

N → Repair the wiring.

N → Is the wiring between 8th pin of J1 on the YL board and 8th pin of P112 on the master board proper?

N → Repair the wiring.

Y → Failure of the YL power supply board.
Replace the YL power supply board with a new one.
(See 6.4.3.)

4.5.12 Error 50 appears

Error 50 appears when the signal from the photodiode is faulty.

Check TP9 on the master board with the oscilloscope.
Is the ratio between the voltage of TP9 and indication on the energy display is 1V : 2.5mJ?

Y → Failure of the master board.
Replace the master board with a new one.
(See 5.9.)

N ↓

Is the wiring between 4th pin of P110 on the master board and 4th land on the sample board proper?

N → Repair the wiring.

Y ↓

Failure of the sample board.
Replace the energy monitor ASSY with a new one.
(See 5.13.)

4.5.13 Error 51 appears

Error 51 appears when the signal from the potentiometer for adjusting the output energy (VR2) is faulty.

Is the voltage of TP8 on the master board between approx. 0.2V (min.) and 4.5V (max.) when the energy control is turned from min. to max.?

Y → Failure of the master board.
Replace the master board with a new one.
(See 5.9.)

N ↓

Failure of the VR2 inside the energy monitor ASSY.
Replace the energy monitor ASSY with a new one.
(See 5.13.)

4.5.14 Error 52 appears

Error 52 appears when the signal from the potentiometer for focus shift (VR3) is faulty.

Is the voltage of TP7 on the master board between approx. 0.5V (ANT500) and 4.5V (POST500) when the YAG focus shift control is turned?

Y → Failure of the master board.
Replace the master board with a new one.
(See 5.9.)

N ↓

Failure of the VR3 inside the focus ASSY.
Replace the focus ASSY with a new one.
(See 5.10.)

4.5.15 Error 53 appears

Error 53 appears when only one microswitch in the trigger switch is turned ON.

• Hand switch

Is the voltage of 1-3 and 2-3 of J115 on the master board changed from HIGH (5V) to LOW (0V) when the hand sw is pressed?

Y → Failure of the master board.
Replace the master board with a new one.
(See 5.9.)

N ↓

Repair the wiring inside the HAND SW ASSY.

• Foot switch

Check the voltage between 8th and 10th and 9th and 10th of J113 on the master board using the multimeter.
Is the output voltage DC12V?

N → Failure of the master board.
Replace the master board with a new one.
(See 5.9.)

Y ↓

Disconnect connector P4 of the foot switch.
Is the output voltage between 8th and 10th and 9th and 10th of J113 on the master board still DC12V?

N → Wiring failure inside the foot switch.
It is necessary to repair.

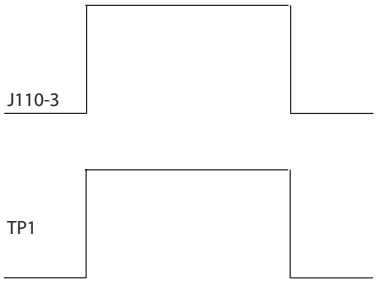
Y ↓

Wiring failure between P113 and J4 in the YC-1600 main body.
It is necessary to repair.

4.5.16 Error 54 appears

Error 54 appears when the input signal of the number of pulses is faulty.

Check the signals of 3rd pin of J110 on the master board and the signal of TP1 on the sample board.



Waveform of TP1 and J110-3

↓

Is the signal of 3rd pin of J110 output properly? → N → Failure of the sample board.
Replace the energy monitor ASSY with a new one.
(See 5.13.)

↓ Y

Is the waveform of TP1 output properly? → N → Failure of the sample board.
Replace the energy monitor ASSY with a new one.
(See 5.13.)

↓ Y

Is the wiring between the land 3 on the sample board and 7th pin of P110 on the master board proper? → N → Failure of the master board.
Replace the master board with a new one.
(See 5.9.)

↓ Y

Repair the wiring.

4.5.17 Error 90 appears

Error 90 appears when the program is faulty.

Replace the IC1 on the master board.

4.6 The illumination light is not projected

This trouble may occur when the power goes off or in the event of a contact failure of connectors.

Is the illumination light projected when the brightness control is turned clockwise?
→ Y: End
↓ N

Is the illumination light projected when the slit width is spread?
→ Y: End
↓ N

Is the filament of the illumination lamp burnt?
→ Y: Replace the illumination lamp with a new one.
(Refer to the operator's manual of the YC-1600.)
↓ N

Is the voltage between J8 and J9 terminals DC +10 to 12V when the brightness control is fully turned clockwise?
→ N: Failure of the VR1 inside the illumination ASSY.
Replace the illumination ASSY with a new one.
(See 5.21.)
↓ Y

Is the voltage between A1 and A2 on the illumination board DC +10 to +12V?
→ N: Failure of the illumination board.
Replace the illumination ASSY with a new one.
(See 5.21.)
↓ Y

Is the voltage between 3rd (+) and 14th (-) pins of P113 on the master board DC 10 to 12V?
→ N: Failure of the master board.
Replace the master board with a new one.
(See 5.9.)
↓ Y

Contact failure of the connector P113 on the master board or cables.
Check the continuity and repair the failed part.

4.7 The focusing rod looks like shifting when the PD is adjusted

Adjust the optical axis with the binocular tube if the illumination light shifts from the center of the visual field through the eyepieces when the pupil distance is changed by looking through the binocular tube for each eye. (See 6.1.3.)

4.8 The illumination light is shifted from the center of Microscopic visual field when the magnification is 10×

Does the illumination light shift to the same direction if the binocular tube is attached upside-down.

N → Adjust the optical axis by the binocular tube. (See 6.1.3.)

↓ Y

Adjust the optical axis by turning the microscope head.
(See 6.1.4.)

4.9 The focusing rod cannot be seen clearly

This trouble may occur when the dioptric power is not properly adjusted.

Is it possible to adjust the focus for each eye by turning the visual power control of eyepieces?

N → Wipe the objective lens and eyepiece lens with the mixed solvent of alcohol.

↓ Y

Replace to the new eyepieces.

4.10 There are some spots in the illumination light

This trouble may occur when there is dirt on the optical path of the illumination light.

Does the spot disappear by turning the filter disk? —Y→ Remove the dirt on the filter. (See 6.2.2.)

↓ N

Dismount the focusing rod.

↓

Move the black paper back and forth along the illumination light. —N→ Clean the optical system of the illumination light. (See 6.2.1.)
Does the spot come into focus before the slit come into focus?

↓ Y

Blow the dirt on the prism of the binocular tube.

4.11 The illumination light is not focused on the focusing rod

This trouble may occur when the focus adjustment of the illumination is not performed well. Adjust the focus of the illumination light. (See 6.2.5 and 6.2.6.)

4.12 The position of illumination light on the focusing rod is not normal

This trouble may occur when the optical axis adjustment of the illumination light is not performed well. Adjust the optical axis of the illumination light. (See 6.2.7.)

4.13 The illumination light does not go out even if the Brightness control is turned fully counterclockwise

This trouble may occur when the variable resister for the brightness of the illumination light (VR1 inside the illumination board) is faulty. Replace the variable resister with a new one. (See 5.21.)

4.14 The slit image tilts when turning it to the vertical position

Adjust the vertical position of the slit image. (See 6.2.11.)

4.15 The slit does not fully close or open

Adjust the closing and opening of the slit. (See 6.2.12 - 6.2.14.)

4.16 The position where the slit closes is shifted from the center

Adjust the position of the slit shutter. (See 6.2.15 and 6.2.16.)

4.17 Coarse movement to back and forth is not smooth

This trouble may occur when the foreign substance adheres to the pinion (axle) or rack (rail).

Remove the cover of the wheel.

↓

Are the tooth of the pinion and rack normal? —N→ Replace the failed pinion or rack with a new one. (See 5.14 and 5.15.)

↓ Y

Does the foreign substance adhere to the pinion and rack? —Y→ Remove the foreign substance.

↓ N

Are the pinion and rack parallel? —N→ Replace the wheel shaft with a new one. (See 5.15.)

↓ Y

Are the positions of the racks which engage with the pinions the same in right and left? —N→ Adjust the right and left positions of the racks which engage with the pinons so that they become the same.

↓ Y

Adjust the racks so that they become parallel.

4.18 Coarse movement to right and left is not smooth

This trouble may occur when the foreign substance adheres to the wheel shaft.

Is there a nick on the wheel shaft? —Y→ Replace the wheel shaft with a new one. (See 5.15.)

↓ N

Does foreign substance adhere to the wheel shaft? —Y→ Remove the foreign substance.

↓ N

Replace the wheel shaft with a new one.
(See 5.15.)

4.19 Fine movement to back and forth, and to right and left is not smooth

Replace the plate with a new one. (See 5.16.)

4.20 Vertical movement is not smooth

Adjust the support for the vertical movement. (See 6.24.)

4.21 Aiming beam is not emitted

Does the Aiming OFF indicator light?
- Y → Press the aiming switches so that the aiming beam is turned ON.
- N ↓

Failure of the aiming laser (laser diode).

4.22 The STATUS indicator for READY mode does not light

Does the Aiming OFF indicator light?
- Y → Press the aiming switches so that the aiming beam is turned ON.
- N ↓

Wipe the side without the blue mark of the flexible cable (between J106 and J201) with the alcohol.

↓

Does the STATUS indicator for the READY mode light?
- Y → End
- N ↓

Replace the display board ASSY with a new one.
(See 5.11.)

↓

Does the STATUS indicator for READY mode light?
- N → Failure of the master board.
  Replace the master board with a new one.
  (See 5.9.)
- Y ↓

End

4.23 The position of burnt pattern is not same to the projected position of the aiming beam

Adjust the optical axis of the YAG laser beam. (See 6.4.5.)

4.24 There is an unevenness in the burnt pattern

This trouble may occur when there is dirt on the optical system of the YAG laser beam.
[CAUTION] Be sure to use the tape on the surface of the burn paper to prevent soot from adhering to the optical system when checking the burnt pattern of the YAG laser beam inside the system.

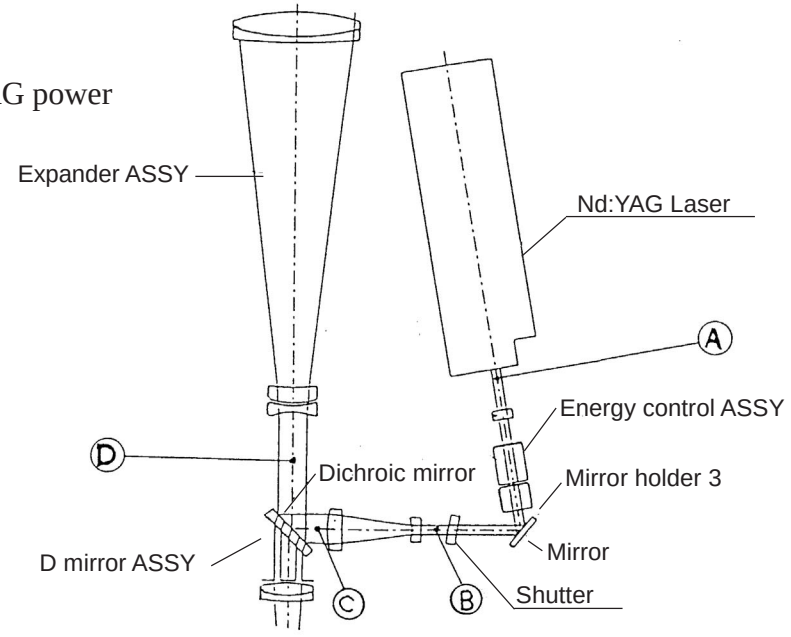
Is there an unevenness on the burnt pattern at the front of the beam expander (expander ASSY) (“D” in the fig. below)?
N → Remove dirt on the beam expander with the blower.
↓ Y

Is there an unevenness on the burnt pattern at the front of the dichroic mirror (D mirror ASSY) (“C” in the fig. below)?
N → Remove dirt on the dichroic mirror with the blower.
↓ Y

Is there an unevenness on the burnt pattern at the front of the mirror (mirror holder 3) (“B” in the fig. below)?
N → Remove dirt on the mirror with the blower.
↓ Y

Is there an unevenness on the burnt pattern between the YAG laser head and energy control ASSY (“A” in the fig. below)?
N → Remove dirt on the energy control ASSY with the blower.
↓ Y

Failure of the YAG laser head.
Replace the YAG laser head and YAG power supply board with new ones.
(See 5.12 and 5.20.)



4.25 Setting of the number of pulses cannot be changed

Wipe the side without the blue mark, of the flexible cable (between J106 and J201) with the alcohol.

↓

Can the number of pulses be set? —Y→ End

↓ N

Replace the display board ASSY with a new one.
(See 5.11.)

↓

Can the number of pulses be set? —N→ Failure of the master board.
Replace the master board with a new one.
(See 5.9.)

↓ Y

End

4.26 Counter display cannot be reset to “0”

Wipe the side without the blue mark of the flexible cable (between J106 and J201) with the alcohol.

↓

Can the counter display be reset to “0”? —Y→ End

↓ N

Replace the display board ASSY with a new one.
(See 5.11.)

↓

Can the counter display be reset to “0”? —N→ Failure of the master board.
Replace the master board with a new one.
(See 5.9.)

↓ Y

End

4.27 The measured energy of YAG laser beam is not normal

This trouble may caused by the misadjustment of the indication on the energy display or malfunction of the YAG laser head.

Adjust the energy of the YAG laser.
(See 6.4.10.)

↓

Is the problem solved? → N → Failure of the YAG laser head.
Replace the YAG laser unit and YL power supply board with new ones.
(See 5.12 and 5.20.)

↓ Y

End

4.28 The system does not stop with the Emergency stop switch

Is the Emergency stop switch normal? → N → Replace the Emergency stop switch with a new one.
(See 5.6.) (See 5.6.)

↓ Y

Repair the contacts of 1st and 2nd pins of P502.

§5 REPAIR

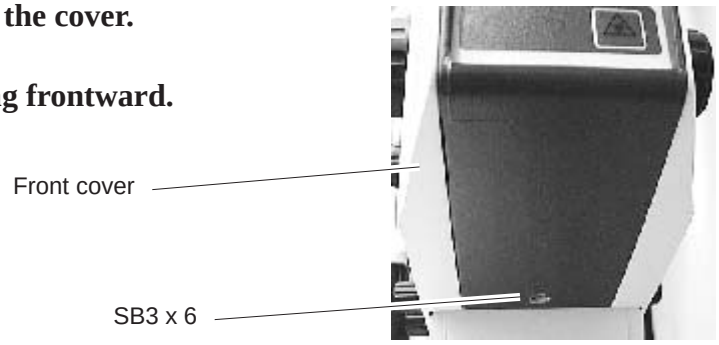
5.1 Removing covers

Removing procedure of exterior covers of the YC-1600 is as follows.
* The attachment procedures of each cover are the reverse order of each procedures described here.

5.1.1 Right cover

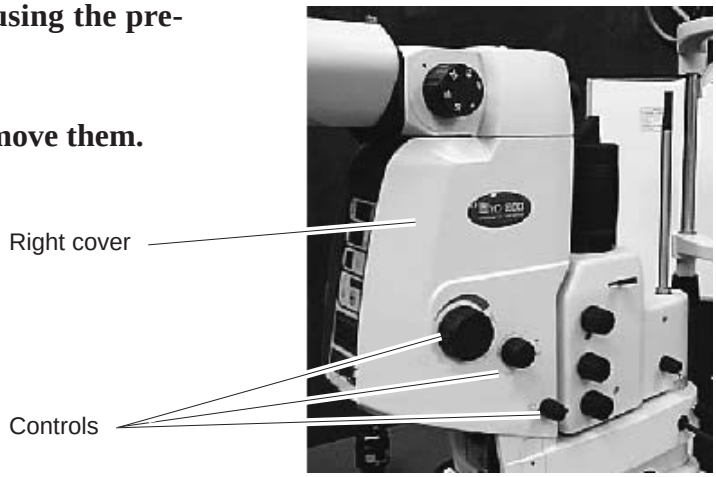
1) Loosen SB3 × 6 on the bottom of the cover.

2) Remove the front cover by pulling frontward.

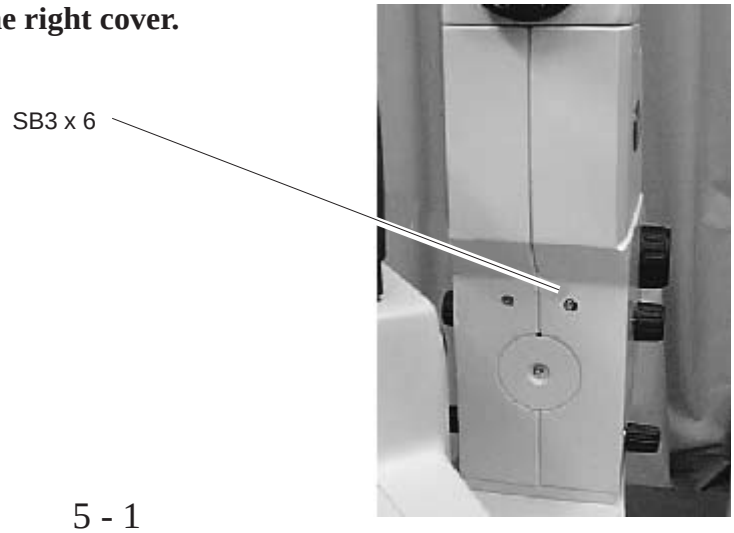


3) Remove caps from the controls using the precise flatblade screwdriver.

4) Loosen nuts in the controls to remove them.

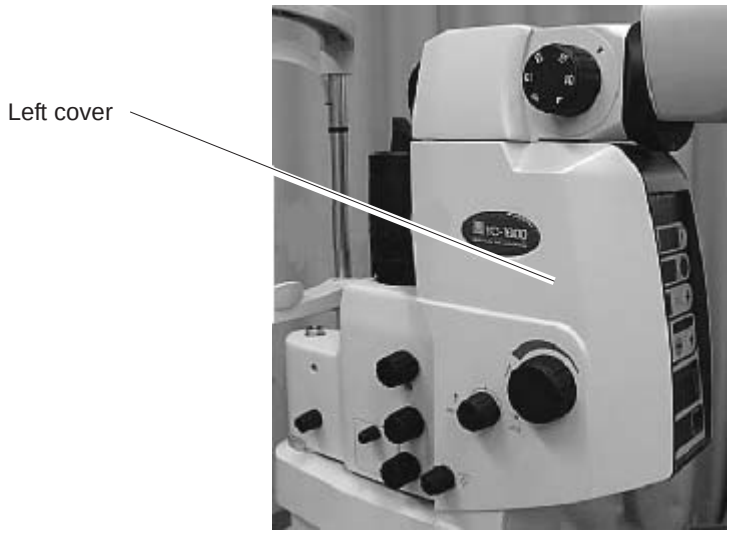


5) Unscrew SB3 × 6 and remove the right cover.



5.1.2 Left cover

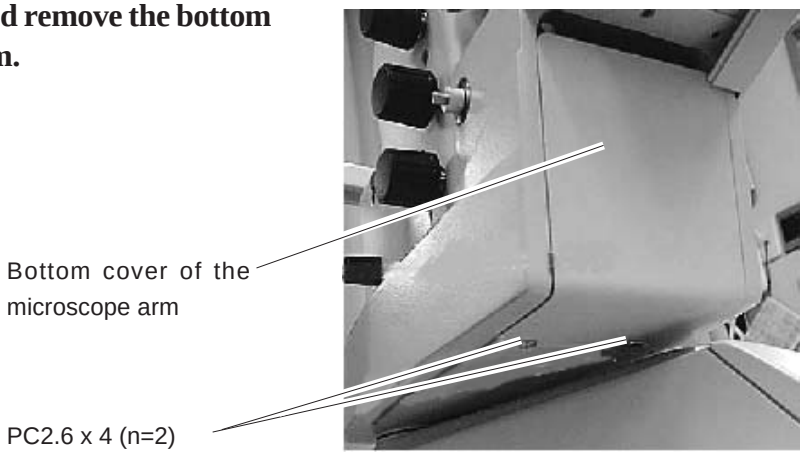
1) **Remove the left cover in the same manner as 5.1.1.**



5.1.3 Bottom cover of the microscope arm

1) **Swing the microscope arm to right or left.**

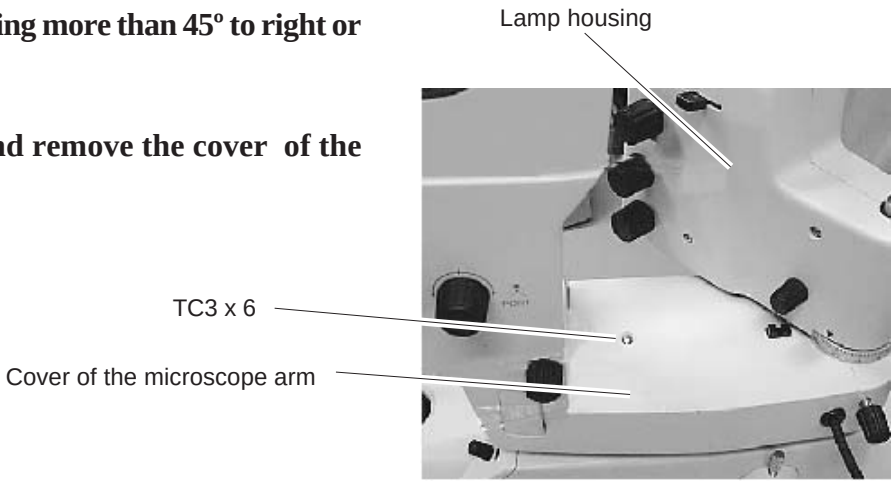
2) **Unscrew PC2.6 × 4 (n=2) and remove the bottom cover of the microscope arm.**



5.1.4 Cover of the microscope arm

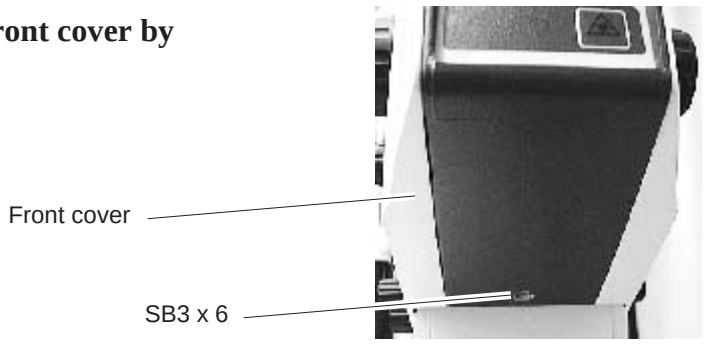
1) **Swing the lamp housing more than 45° to right or left.**

2) **Unscrew TC3 × 6 and remove the cover of the microscope arm.**



5.1.5 Front cover

1) **Loosen SB3 × 6 and remove the front cover by pulling frontward.**

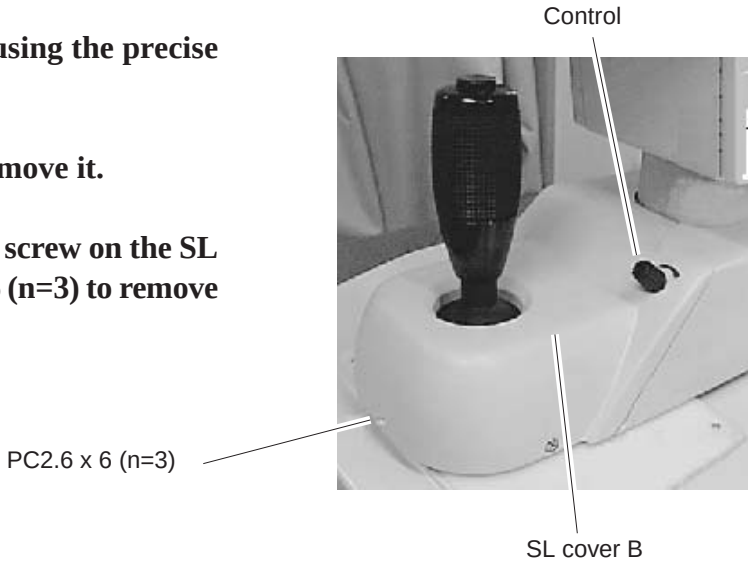


5.1.6 SL cover B

1) **Remove cap from the control using the precise flatblade screwdriver.**

2) **Loosen nut in the control to remove it.**

3) **Remove the blind cover for the screw on the SL cover B, and unscrew PC2.6 × 6 (n=3) to remove the SL cover B.**

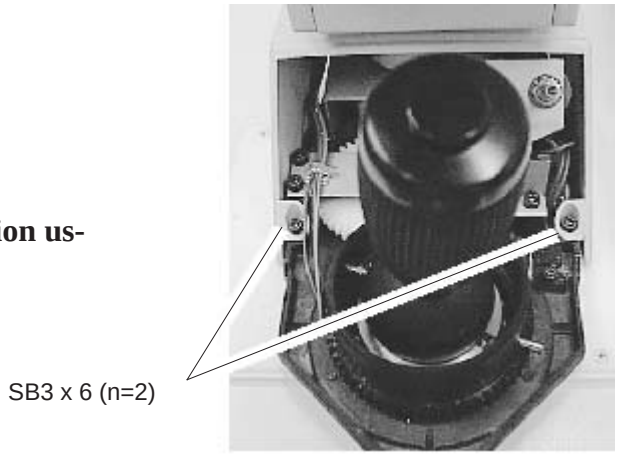


5.1.7 SL cover A

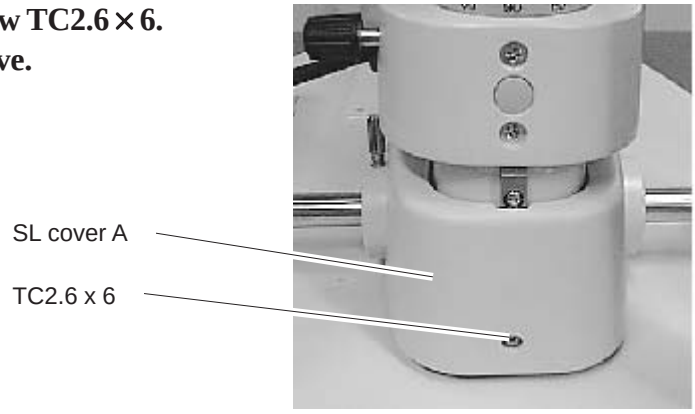
1) **Remove the SL cover B.**
See 5.1.6.

2) **Unscrew SB3 × 6 (n=2).**

3) **Move the microscope to the highest position using the joystick.**

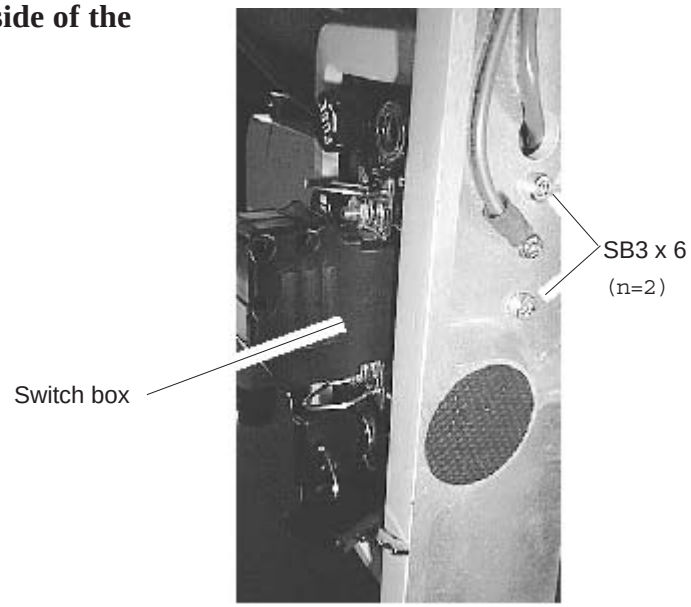


4) **Remove the blind cover, and unscrew TC2.6 × 6. Then lift up the SL cover A to remove.**



5.1.8 Switch box

1) **Unscrew SB3 × 6 (n=2) on the back side of the base and remove the switch box.**



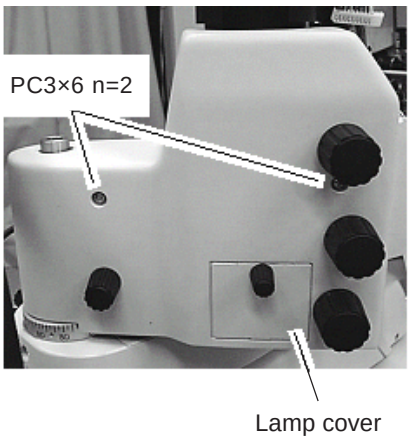
5.1.9 Right cover of the lamp housing

1) **Remove caps from controls (4 parts) using the precise flatblade screwdriver.**

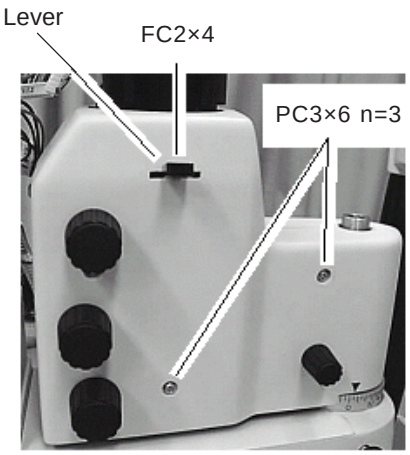
2) **Loosen nuts in the controls to remove them.**

3) **Unscrew FC2 × 4 and remove the lever.**

4) **Unscrew PC3 × 6 (n=2) and remove the right cover of the lamp housing.**



5.1.10 Left cover of the lamp housing



1) **Remove the lamp housing by loosening the control.**

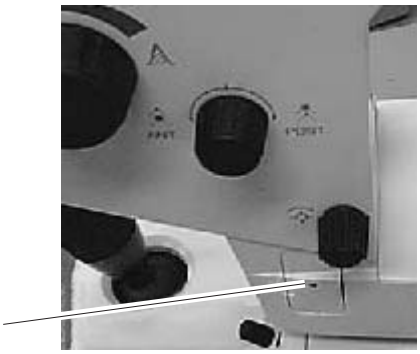
2) **Remove caps from controls (4 parts) using the precise flatblade screwdriver.**

3) **Loosen nuts in the controls to remove them.**

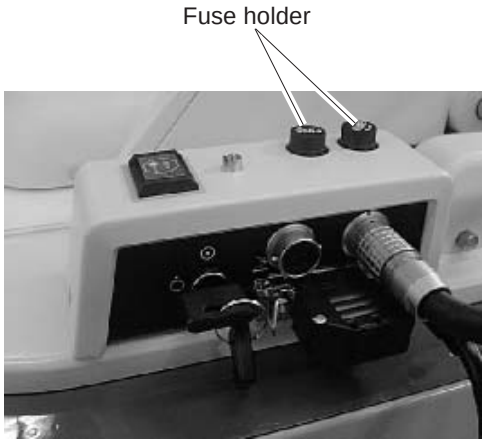
4) **Unscrew PC3 × 6 (n=3) and remove the lamp cover, the lamp housing and the right cover.**

5.1.11 Cover of the aiming adjustment part

1) **Insert the hex. wrench (1.5mm) into the hole at the center of the cover of the aiming adjustment part. Loosen the inside screw and remove the cover.**



5.2 Check and replacement of fuses



1) **Unplug the power cord from the wall outlet.**

2) **Turn the fuse holder counterclockwise and remove it. Then pull out fuses.**

3) **Check the continuity between at both ends of fuses using the resistance range of the multimeter.**

4) **If the fuses burn (there is no continuity), replace them with new ones.**

5.3 Voltage check for wall outlet

1) Check the voltage between both polarities of the wall outlet using the AC range of the multimeter.

[CAUTION] Pay attention not to get an electric shock.

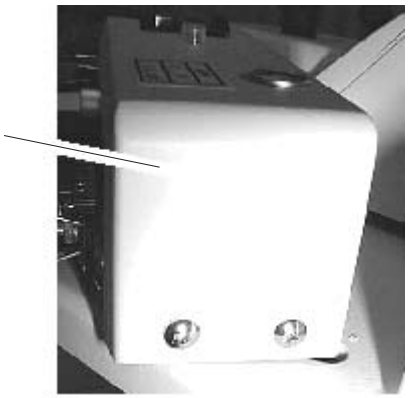
If the proper voltage (nominal voltage ±10%) is not supplied, the system cannot be used. Use the voltage regulator to supply the proper voltage.

5.4 Replacement of key control switch

1) Verify that the key switch is in the OFF position.

2) Remove the switch box.
See 5.1.8.

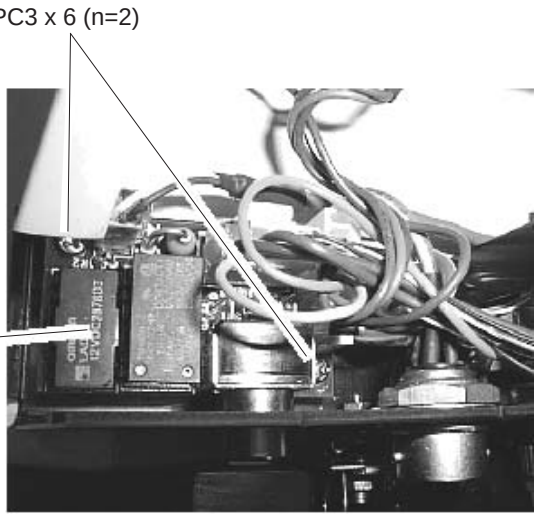
3) Unscrew TC3 × 6 (n=3) and remove the cover of the switch box.



4) Disconnect P501, P502 and P503 from the key switch board.

5) Unscrew PC3 × 6 (n=2) and remove the key switch board.

6) Attach a new key switch board in the reverse order.



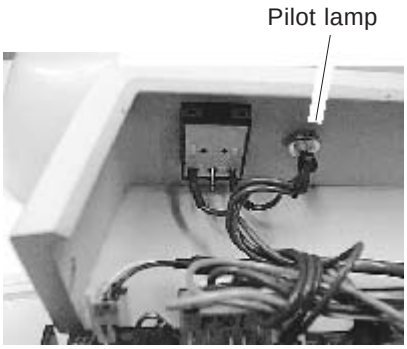
5.5 Replacement of the pilot lamp

1) Verify that the key switch is in the OFF position.

2) Remove the switch box.
See 5.1.8.

3) Unsolder the cord, which has been soldered to

the pilot lamp, using the soldering iron.



4) **Remove the nut and washer, then remove the pilot lamp.**

5) **Attach a new pilot lamp in the reverse order.**

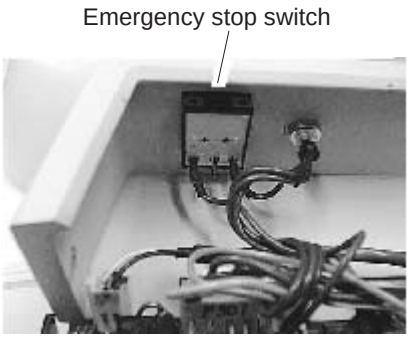
5.6 Replacement of the Emergency stop switch

1) **Verify that the key switch is in the OFF position.**

2) **Remove the switch box.**
   See 5.1.8.

3) **Check the continuity between 1st and 2nd pin of P502 using the resistance range of the multimeter.**
   If there is no continuity under the condition that the emergency stop switch is not pressed, and if there is continuity under condition that the emergency stop switch is not pressed, there is no problem. If not, replace the emergency stop switch in the following procedures.

4) **Unsolder the cord, which has been soldered to the emergency stop switch, using the soldering iron.**



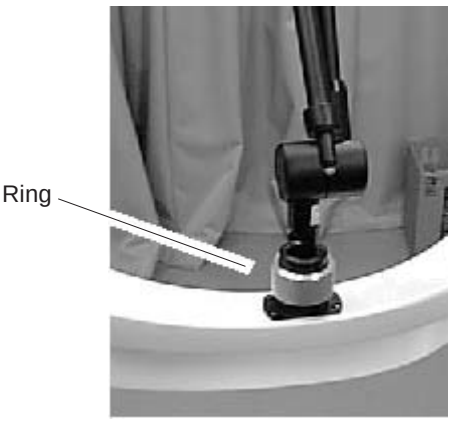
5) **Remove the emergency stop switch.**

6) **Attach a new emergency stop switch in the reverse order.**

5.7 Replacement of the fixation lamp ASSY

1) **Loosen the ring at the joint of the fixation lamp and remove the fixation lamp ASSY.**

2) **Assemble a new fixation lamp ASSY.**



5.8 Replacement of the switching power supply

1) **Disconnect P2 and remove the PS ASSY.**

2) **Connect P2 of the new PS ASSY to J2 connector.**

5.9 Replacement of the master board

1) **Remove the left cover.**
See 5.1.2.

2) **Remove all connectors on the master board.**

3) **Loosen PC3 × 10 (n=3) and remove the control board ASSY.**
[CAUTION] Do not unscrew PC3 × 10 (n=3) completely but loosen until the master board can be removed to prevent washer on the back of the board from dropping.

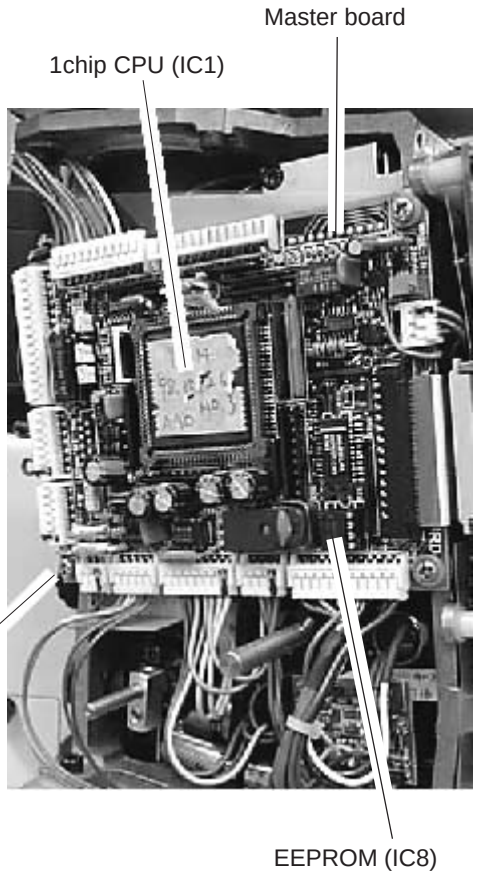
4) **Assemble the new master board in the reverse order.**

5) **Replace 1 chip CPU (IC1) and EEPROM (IC8).**

6) **Readjust the aiming power MAX and the aiming power MIN.**
See 6.3.7. and 6.3.8.

7) **Check the focus shift.**
See 6.4.9.

8) **Verify that the actual output energy and indicated output energy are the same.**
See 6.4.10.



5.10 Replacement of the focus ASSY

1) Remove the right cover.
See 5.1.1.

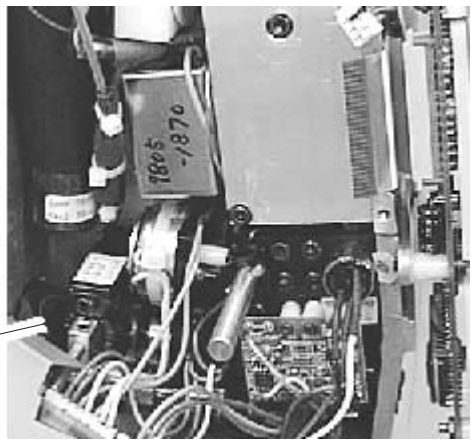
2) Remove the left cover.
See 5.1.2.

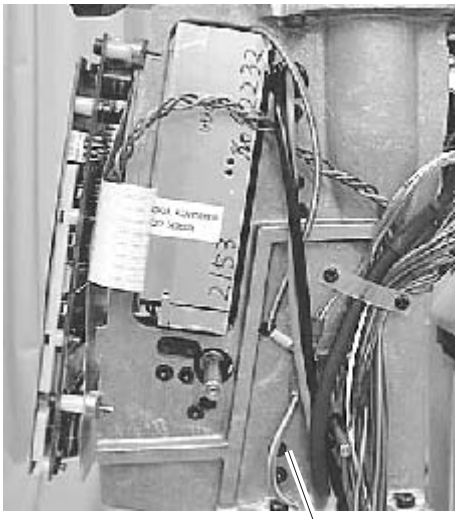
3) Remove the control board ASSY.
See 5.9.

4) Loosen SB3 × 4 (n=3) and remove the focus ASSY.
[CAUTION] Hold the focus ASSY with hand to prevent scratches on the glass parts when removing the focus ASSY.

5) Assemble the new focus ASSY in the reverse order.

6) Verify the optical axis of the YAG laser beam.
See 6.4.6.





5.11 Replacement of the display board ASSY

1) **Remove the right cover.**
   See 5.1.1.

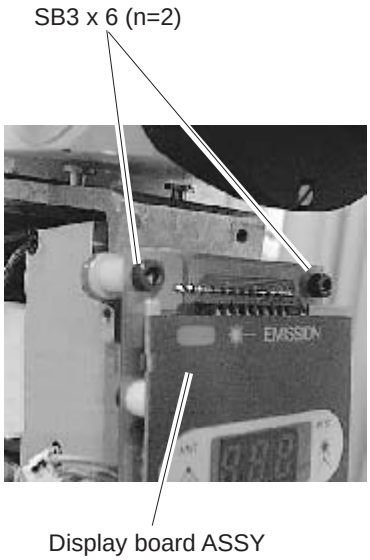
2) **Remove the left cover.**
   See 5.1.2.

3) **Remove the control board ASSY.**
   See 5.9.

4) **Swing the microscope arm more than 45° to right or left.**

5) **Loosen SB3 × 6 (n=2) and remove the display board ASSY.**

6) **Assemble the new display board ASSY in the reverse order.**



5.12 Replacement of the YAG laser unit

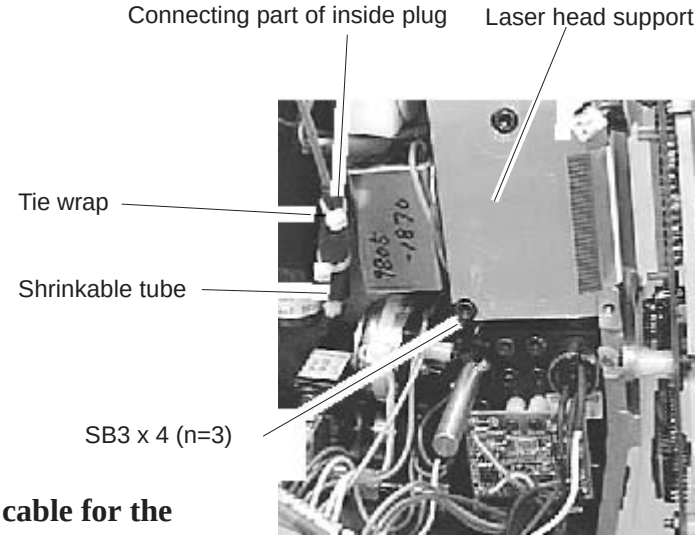
1) **Remove the right cover.**
   See 5.1.1.

2) **Remove the left cover.**
   See 5.1.2.

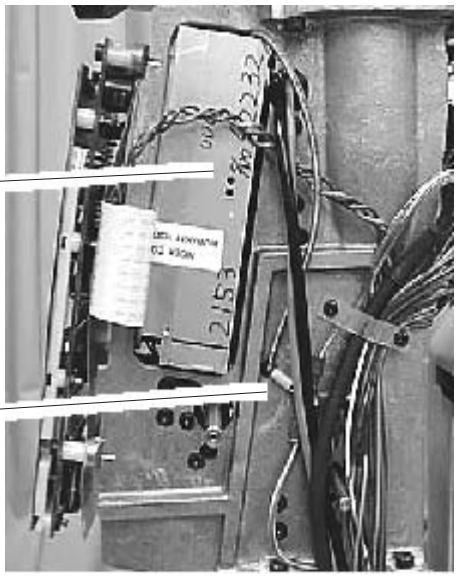
3) **Remove the master board.**
   See 5.9.

4) **Remove the display board ASSY.**
   See 5.11.

5) **Remove the plug connector of the cable for the YAG laser unit.**
   Cut the tie wrap and shrinkable tube with the nipper, then disconnect the inside plug by holding it with the needle nose wrench.



6) Loosen PC3 × 4 and remove the GND cables from the YAG laser unit.



7) Loosen SB3 × 6 (n=3) and remove the YAG laser unit from the laser head support.

8) Assemble the new YAG laser unit in the reverse order.

9) Adjust the PFN voltage.
See 6.4.3.

10) Verify the optical axis of the YAG laser beam and adjust it.
See 6.4.5.

11) Adjust the energy of the YAG laser beam.
See 6.4.10.

12) Assemble the removed parts in the reverse order.

5.13 Replacement of the energy monitor ASSY

1) **Remove the right cover.**
   See 5.1.1.

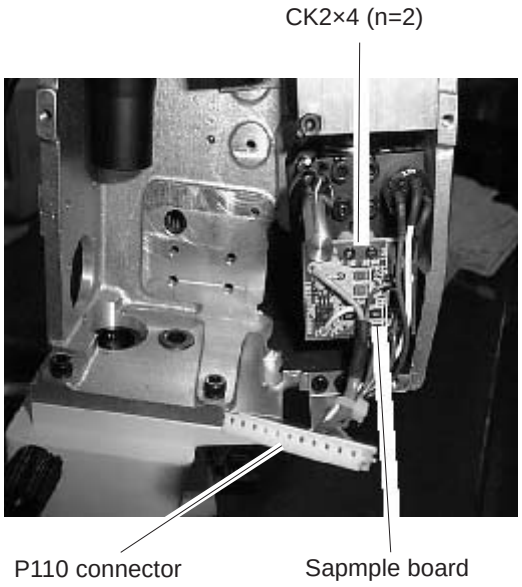
2) **Remove the left cover.**
   See 5.1.2.

3) **Disconnect P110 on the master board.**

4) **Unscrew CK2 × 4 (n=2) and remove the sample board.**

5) **Assemble the new sample board in the reverse order.**

6) **Adjust the focus of the YAG laser beam.**
   See 6.4.8.

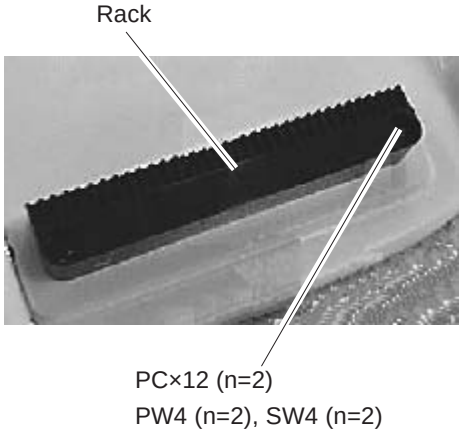


5.14 Replacement of the rack

1) **Unscrew fixing screw B (n=2) and remove the cover for pinion.**

2) **Unscrew PC4 × 12 (n=2), PW4 (n=2), and SW4 (n=2) and remove the rack.**

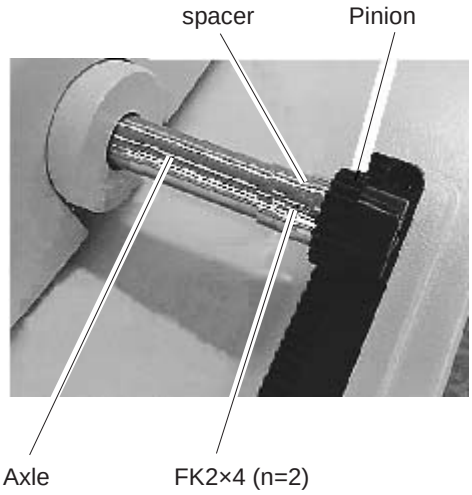
3) **Attach a new rack in the reverse order.**



5.15 Replacement of the wheel shaft

1) **Remove the cover for pinion.**
   See 5.14.

2) **Remove the pinions by unscrewing screws which fix them.**
   See 5.15.



3) **Remove the right and left spacers by unscrewing FK2 × 4 (n=2) which fix them.**

4) **Loosen the fixing screw and remove the wheel shaft.**

5) **Attach a new wheel shaft in the reverse order.**

5.16 Replacement of the plate

1) **Unscrew FC2 × 4 (n=2) and remove the plate.**

2) **Attach a new plate in the reverse order.**

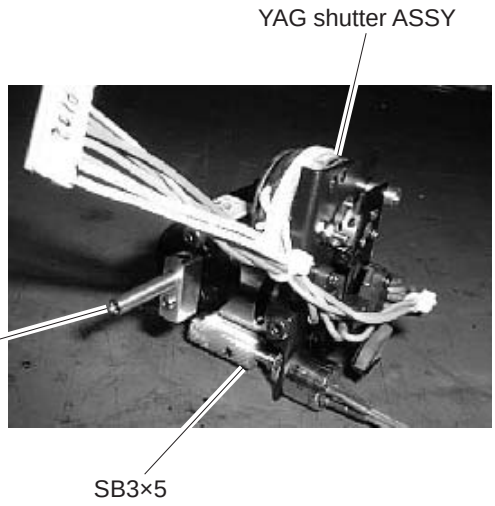
5.17 Replacement of the YAG shutter ASSY

1) **Remove the focus ASSY.**
   See 5.10.

2) **Unscrew SB3 × 5 and remove the YAG shutter ASSY.**

3) **Assemble the new YAG shutter ASSY in the reverse order.**

4) **Adjust the position of the Focus ASSY.**
   See 6.4.6.



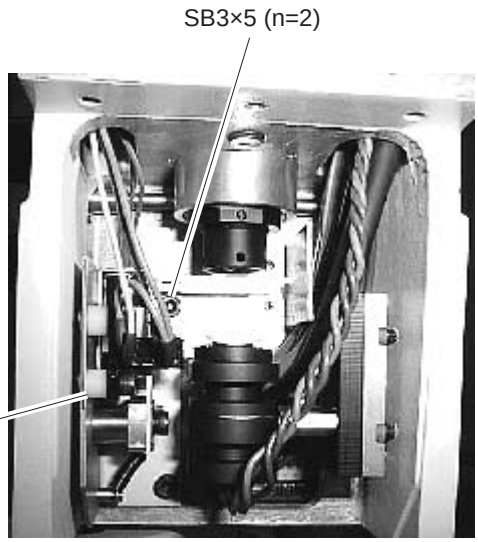
5.18 Replacement of the aiming shutter ASSY

1) **Remove the left cover.**
   See 5.1.2.

2) **Disconnect P103 on the master board.**

3) **Remove the bottom cover of the microscope arm.**
   See 5.1.3.

4) **Loosen SB3 × 5 (n=2) and remove the aiming shutter ASSY.**



5) **Assemble the new aiming shutter ASSY in the reverse order.**

5.19 Replacement of the YL cable ASSY

1) **Remove the left cover.**
   See 5.1.2.

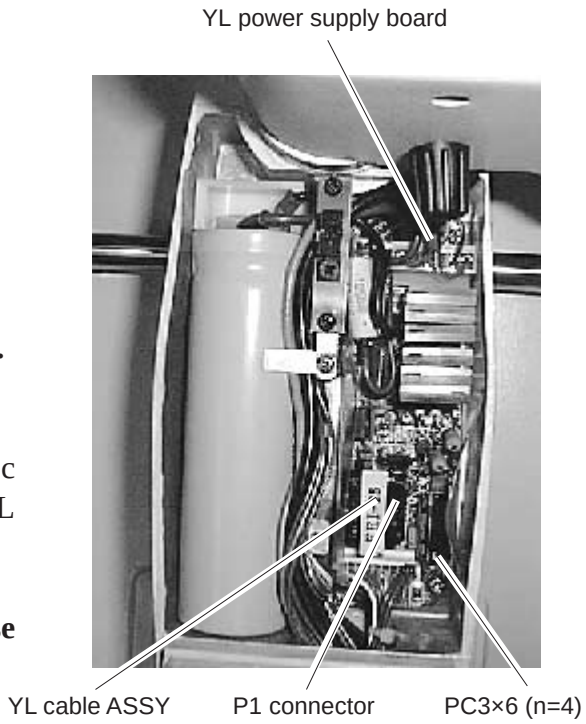
2) **Disconnect P112 on the master board.**

3) **Remove the cover of the microscope arm.**
   See 5.1.4.

4) **Disconnect P1 on the YL power supply board.**

5) **Remove the YL cable ASSY (P1-P112 cable).**
   [CAUTION] Pay attention not to get an electric shock since the high voltage is applied in the YL power supply board.

6) **Assemble the new YL cable ASSY in the reverse order.**



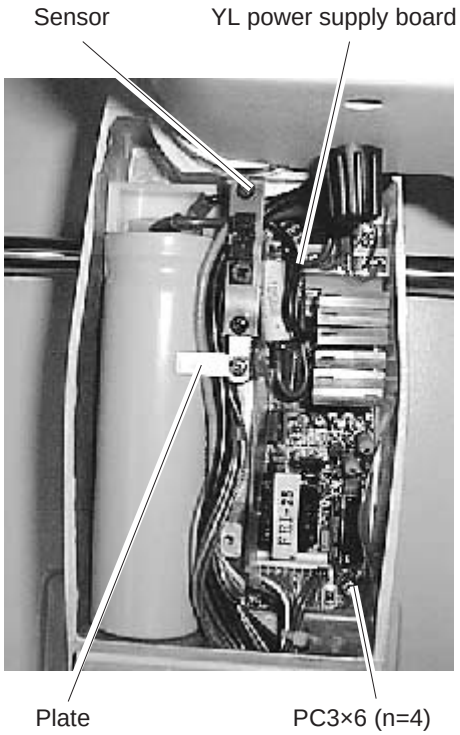
5.20 Replacement of the YL power supply board

1) **Remove the cover of the microscope arm.**
   See 5.1.4.

2) **Disconnect P1 and P2 on the YL power supply board.**

3) **Loosen PC3 × 6 and remove the fixing plate of the condenser.**

4) **Loosen PC3 × 6 (n=4) and remove the YL power supply board.**
   [CAUTION] Pay attention not to get an electric shock since the high voltage is applied in the YL power supply board.



5) Unscrew PC3 × 6 (n=4) and remove the sensor which detects the position of the lamp housing.

6) Assemble the new YL power supply board in the reverse order.

7) Adjust the PFN voltage.
See 6.4.3.

5.21 Replacement of the illumination ASSY

1) Remove the SL cover A.
See 5.1.7.

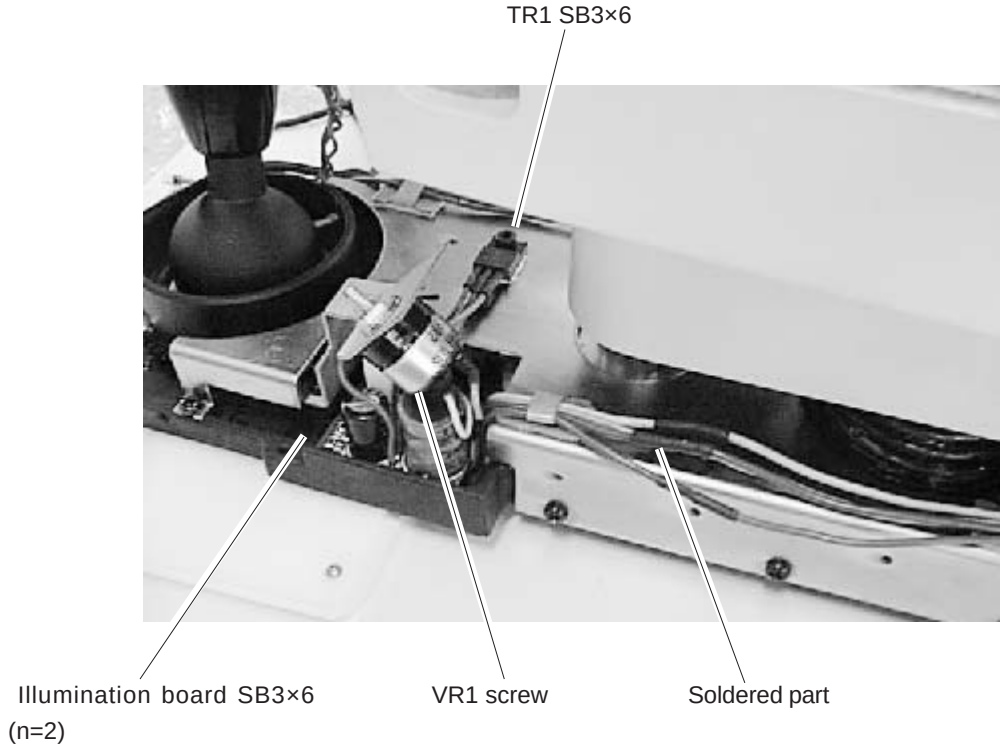
2) Loosen SB3 × 5 (n=2) and remove the illumination board.

3) Remove the variable resister (VR1) by unscrewing the screw for it.

4) Unscrew SB3 × 6 and remove the transistor (TR1).

5) Unsolder the cable.

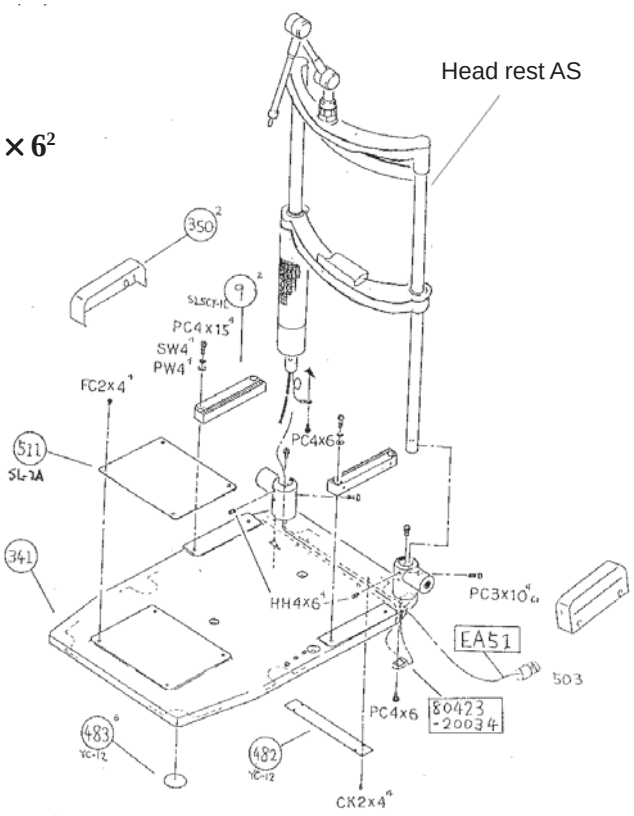
6) Assemble the new illumination ASSY in the reverse order.



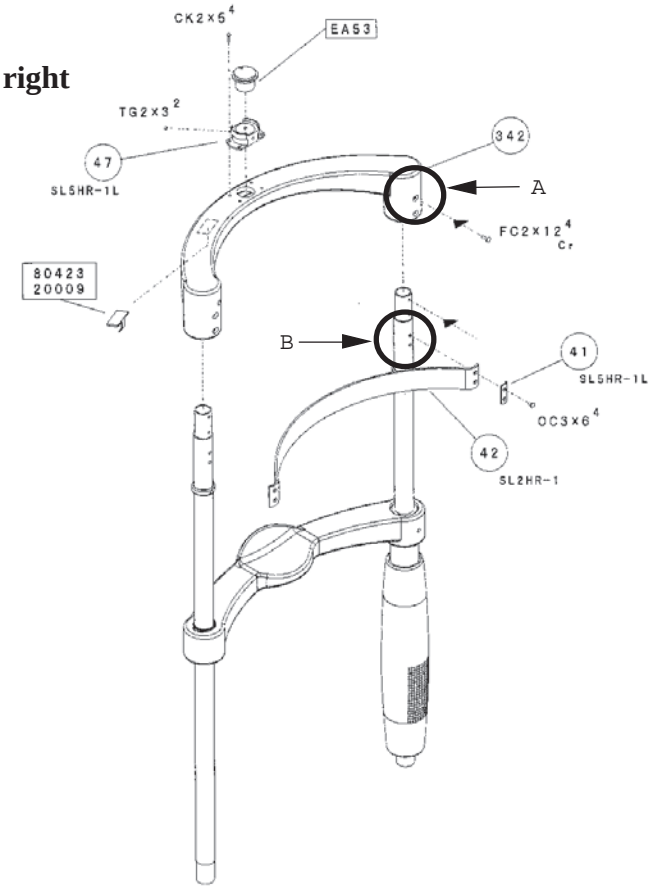
5.22 Replacement of the vertical driving axle of the chin support

* If the chin support goes down during use, replace SL5HR-1L M007 (the vertical driving axle).

1) Unscrew PC3 × 10[4], HH4 × 6[4] and PC4 × 6[2] and remove the head rest AS.

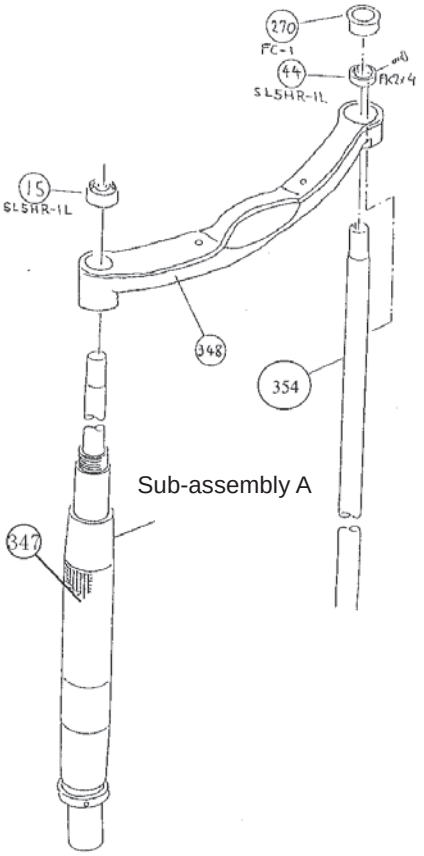


2) Unscrew the screws in A and B in the right figure.



3) **Unscrew M015 and remove the sub-assembly A.**

4) **Remove M347 (grip) form the sub-assembly A.**



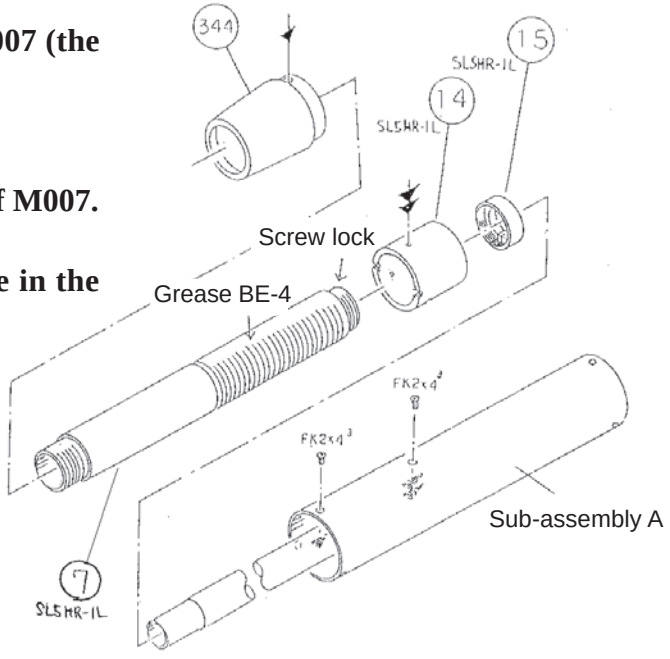
5) **Unscrew the fixing screw (FK2×4^3) and remove M344.**

6) **Unscrew the fixing screw (FK2×4^3) and remove M014.**

7) **Unscrew M015 and remove it from M007 (the vertical driving axle).**

8) **Replace M007 with a new one.**
Apply grease BE-4 to the thread part of M007.

9) **Assemble the new vertical driving axle in the revers order.**



§6 CHECK AND ADJUSTMENT

6.1 Adjustment of the microscope and binocular tube

6.1.1 Check of the optical axis of microscope

1) Set the magnification of the microscope to 10× and the slit length to maximum.

2) Verify the position of the slit image on the focusing rod by looking through the microscope with each eye respectively.

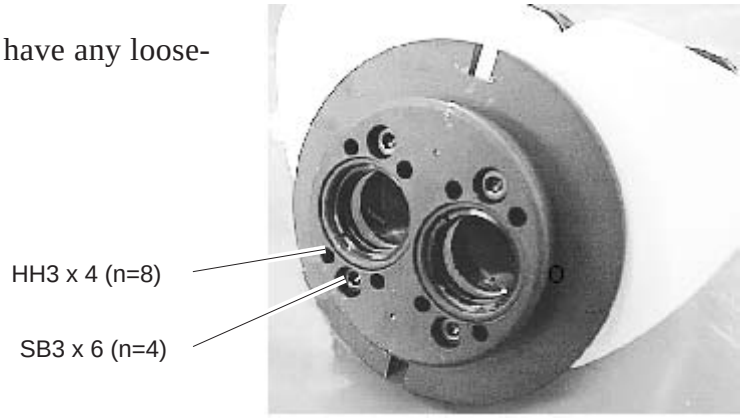
3) Remove the binocular tube and attach it changing its up-and-down direction.

4) Verify the opposite side of the binocular tube of the step 2).

6.1.2 Adjustment of the optical axis with the binocular tube

1) Remove the binocular tube.

2) Adjust the screws (HH3 × 4) on the right/left side to move the visual field.
(If the adjustment is not completed with HH3 × 4, tighten SB3 × 6 again.)
[CAUTION] The screws do not have any looseness.



3) Attach the binocular tube and verify the optical axis of the microscope.
See 6.1.1.

4) Repeat steps 1) to 3) for the fine adjustment.

5) After adjustment, apply the threadlocker to HH3 × 4 and SB3 × 6.

6.1.3 Adjustment of the prism holder position

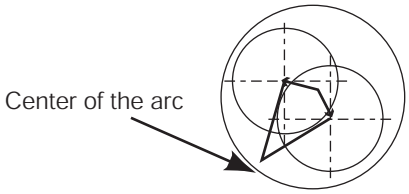
If the slit image shifts in the visual field when the PD is changed, follow the procedure below for adjustment.

1) Unscrew FK2 × 4 (n=4) and remove the cover of the binocular tube.

2) Set the magnification of the microscope to 16× and the illumination spot to ϕ14.

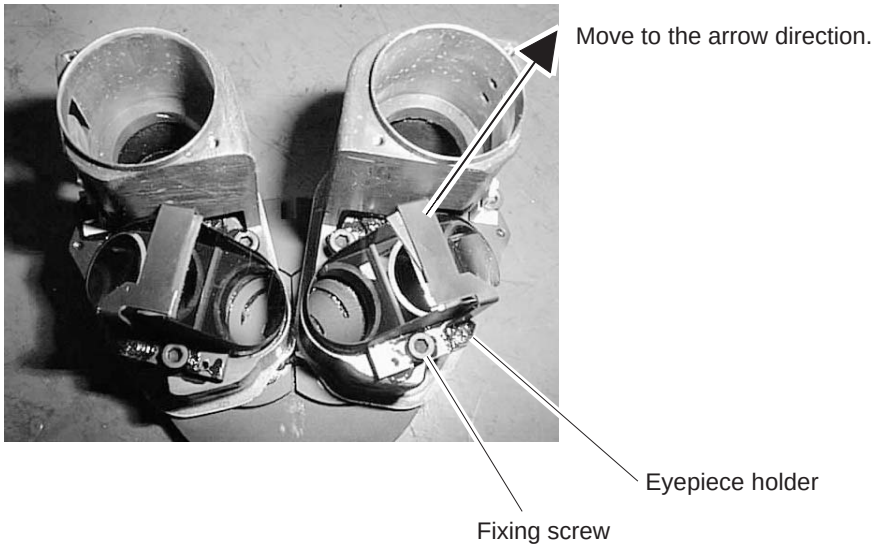
3) Move the right/left prism holder from the minimum to maximum position.
Check the spot image position on the visual field through the eyepiece.

4) Slightly loosen the fixing screw (n=3) of the eyepiece holder.



5) Move the eyepiece lens from the position where is checked in the step 3) to the opposide side of the center of arc drawn by the center of the spot image.

cf. If the spot image moves as shown in the figure on the upper right, move the eyepiece holder in the direction shown by the arrow.



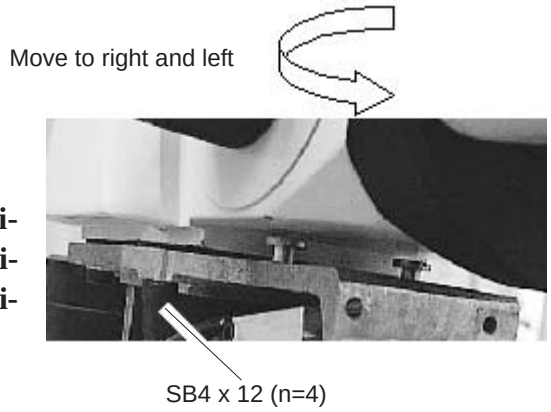
6.1.4 Adjustment of the optical axis with the microscope head

[CAUTION] Never turn the eyepiece dioptric adjustment control during the adjustment.

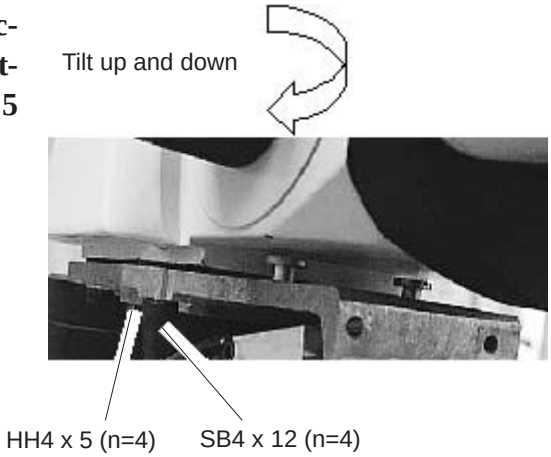
1) **Mount the focusing rod.**

2) **Remove the right and left covers.**
See 5.1.1 and 5.1.2.

3) **If the optical axis deviates in the horizontal direction, loosen SB4 × 12 (n=4) and move the microscope head to right and left to adjust the optical axis.**



4) **If the optical axis deviates in the vertical direction, adjust the tilt of the microscope head by tightening/loosening SB4 × 12 (n=4) and HH4 × 5 (n=4).**

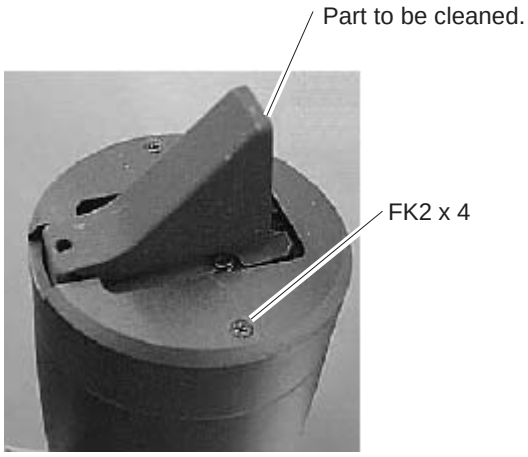


6.2 Adjustment of the illumination part

6.2.1 Cleaning of the optical system for illumination

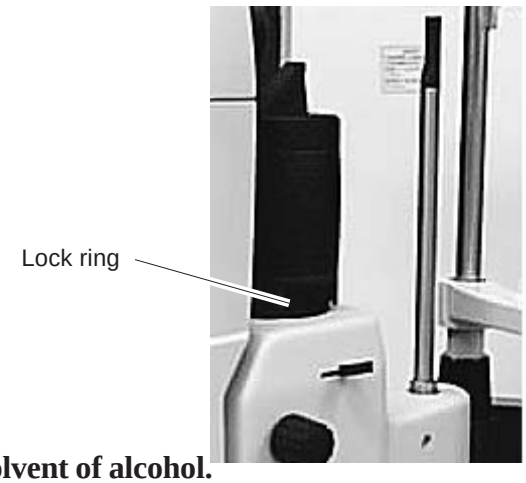
If dirt can be seen in the illumination light, clean the optical system for the illumination as described below.

1) Wipe the prism with the mixed solvent of alcohol.

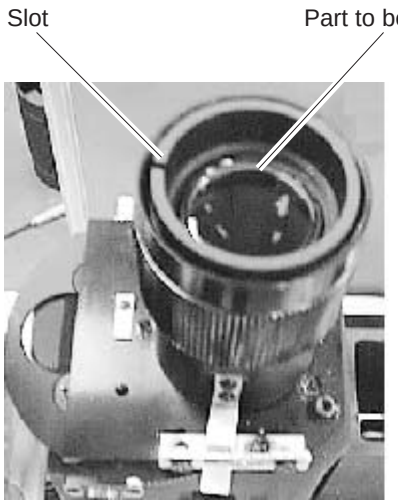


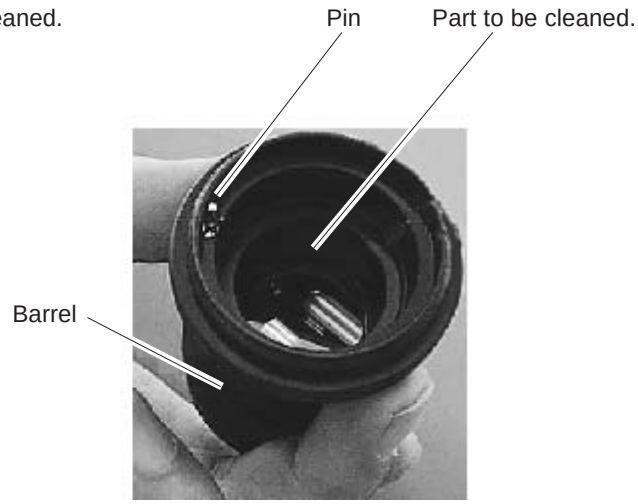
2) Unscrew FK2 × 4 (n=2) and remove the prism head cover.

3) Loosen the lock ring and remove the prism head.



4) Wipe the lens inside the barrel with the mixed solvent of alcohol.



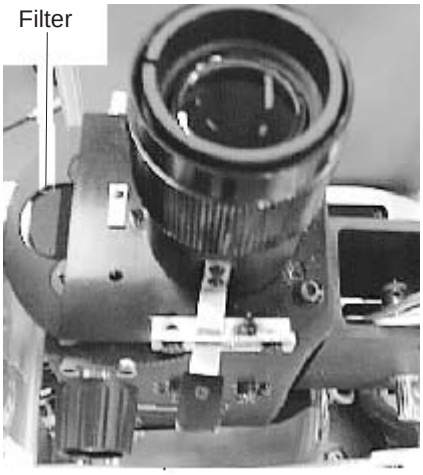


5) Assemble the barrel.
[CAUTION] Be sure to slide the pin into the slot.

6.2.2 Cleaning of the filters

1) Remove the right and left covers of the lamp housing.
See 5.1.9 and 5.1.10.

2) Remove dirt on the filter using the blower and wipe it with the mixed solvent of alcohol.



6.2.3 Cleaning of the slit

1) Remove the right and left covers of the lamp housing.
See 5.1.9 and 5.1.10.

2) Set the slit width to maximum.

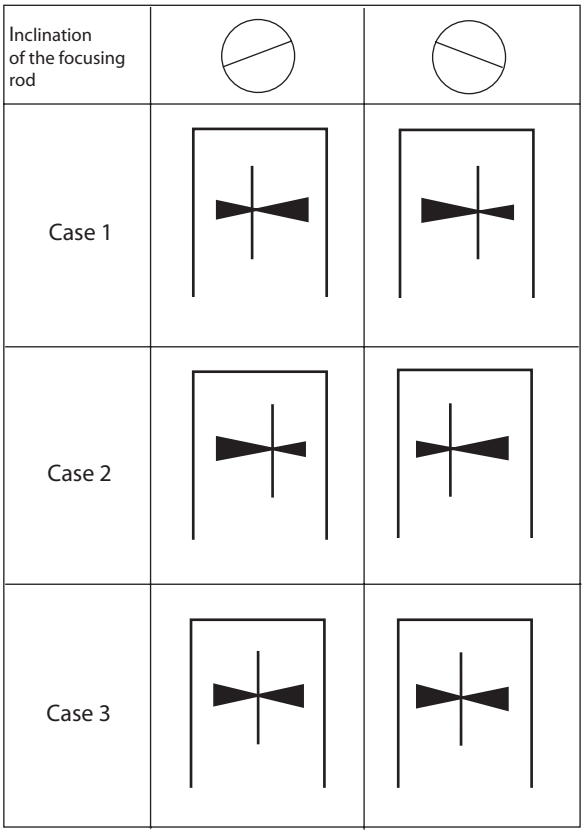
3) Remove dirt on the knife edge using the blower and wipe it with the mixed solvent of alcohol.

6.2.4 Adjustment of the focus of illumination

1) Make the slit image horizontal and thin.

2) Slightly rotate the focusing rod to right and left.

3) Judge the focus of the illumination from the condition of the slit image at this time.
The figure below shows the condition of the slit image and the inclination of the focusing rod.
The thinnest point of the projected slit image is the focusing point.
Case 1: The focusing point of the illumination is anterior.
Case 2: The focusing point of the illumination is posterior.
Case 3: The illumination comes into a focus.



4) If the prism head has no tilting mechanism (13704-4000), perform the adjustment following 6.2.5.
If the prism head has the tilting mechanism (34373-M6934), perform the adjustment following 6.2.6.

6.2.5 Illumination focus adjustment for the prism head without tilting mechanism

1) **Remove the prism head cover. (Refer to 5.6.2 of the operator's manual.)**

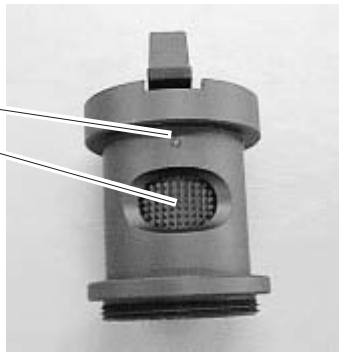
2) **Loosen TG2 × 4 which fixes the projection lens holder inside the prism head.**

3) **Turn the focus adjustment ring on the side of the prism head, and tighten TG2 × 4.**

4) **Attach the removed part.**

5) **Check the focus.**

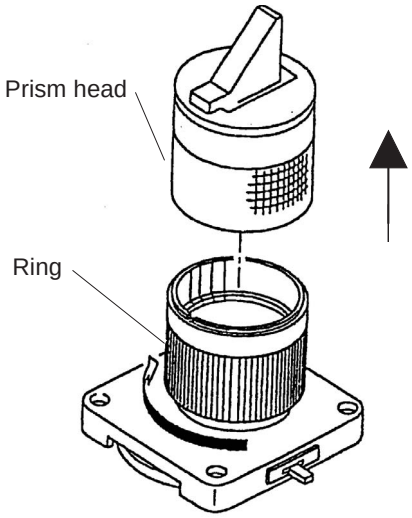
6) **Repeat steps 2) to 5) for fine adjustment.**



6.2.6 Illumination focus adjustment for the prism head with tilting mechanism

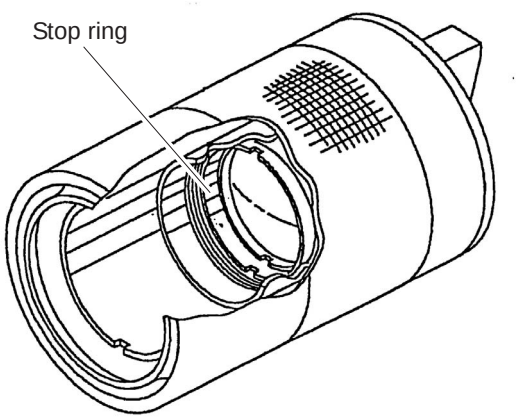
1) **Loosen the ring clockwise and lift up the prism head.**

2) **Apply a thinner to the threadlocker on the stop ring of the prism head.**



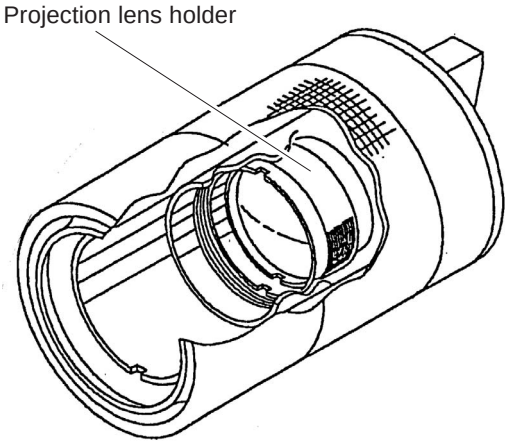
3) Loosen the stop ring with a spanner wrench.

* Pay attention not to scratch the lens with the spanner wrench.



4) Turn the projection lens holder with the precise screwdriver to adjust the focus.

- For case 1: Turn the projection lens holder clockwise.
- For case 2: Turn the projection lens holder counterclockwise.



5) Attach the prism head and check the focus position.

6) Repeat steps 1) to 5) to obtain the focus as case 3.

7) Tighten the stop ring with the spanner wrench.

* Pay attention not to turn the projection lens holder together with the stop ring.

8) Apply the threadlocker to the stop ring.

6.2.7 Check of the optical axis of illumination

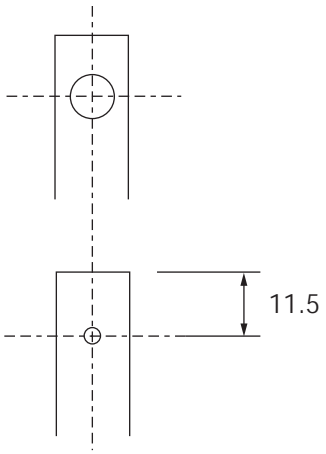
1) **Set the illumination spot to ϕ9 (second largest spot) and the magnification of the microscope to 10×.**

2) **Verify that the illumination image is at the center of the focusing rod.**

3) **Set the illumination spot to ϕ0.2 (minimum spot).**

4) **Verify that the illumination spot is at 11.5mm position from the top of the focusing rod.**

5) **If there is a problem, perform the adjustment following the items 6.2.8 to 6.2.10.**



6.2.8 Adjustment of the optical axis of illumination (horizontal)

Refer to 5.6.2 of the operator's manual.

6.2.9 Adjustment of the optical axis for prism head with tilting mechanism (vertical)

Refer to 5.6.2 of the operator's manual.

6.2.10 Adjustment of the optical axis for prism head with tilting mechanism (vertical)

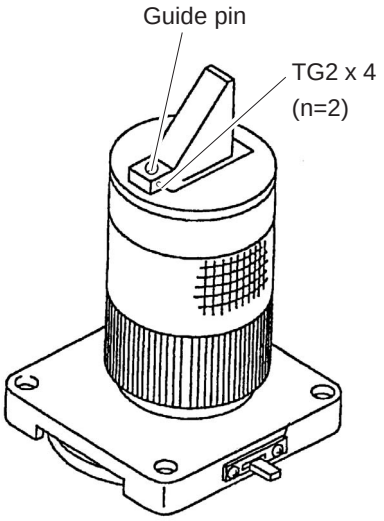
1) **Turn the slit rotation control to 0º (Top level).**

2) **Set the illumination spot to ϕ0.2 (minimum spot).**

3) **Slightly loosen TG2 × 4 of the prism cover.**

4) **Adjust the guide pin of the prism cover to align the vertical position of the illumination spot with the aiming beam.**

5) **Tighten TG2 × 4 to fix the guide pin.**



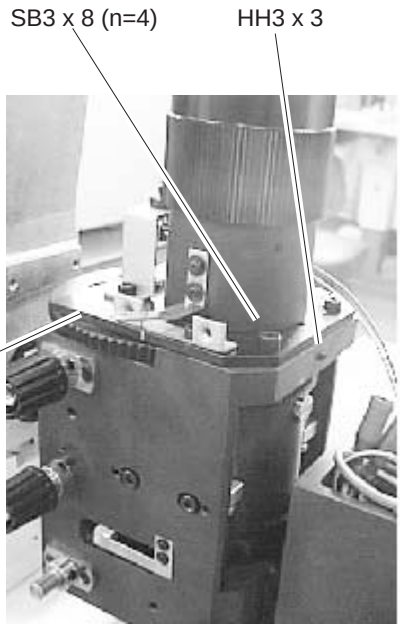
6.2.11 Adjustment of the vertical position of slit

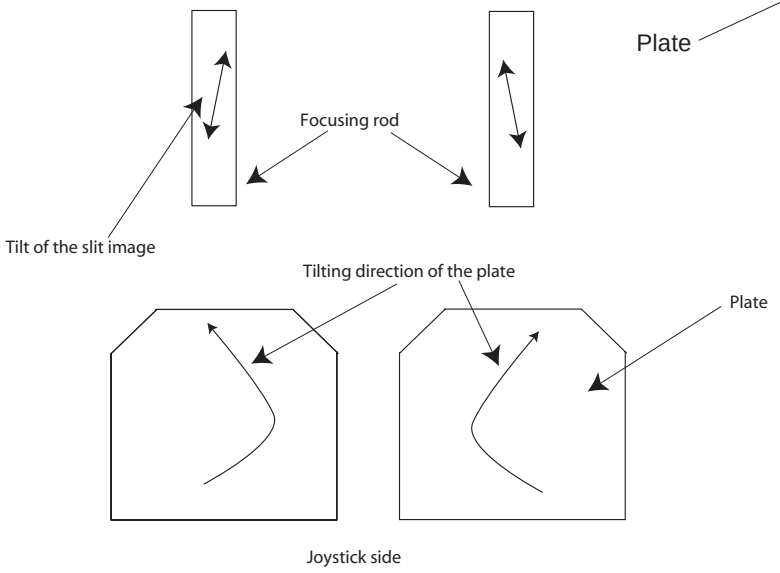
Follow the procedures below to adjust the slit if it is tilted when the slit is turned to be vertical.

1) Remove the right and left covers of the lamp housing.
See 5.1.9 and 5.1.10.

2) Loosen HH3 × 3 and SB3 × 8 (n=4).

3) Tilt the plate to adjust the slit position.



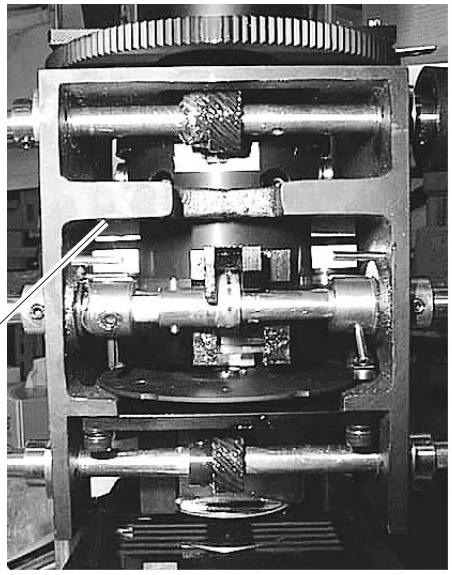


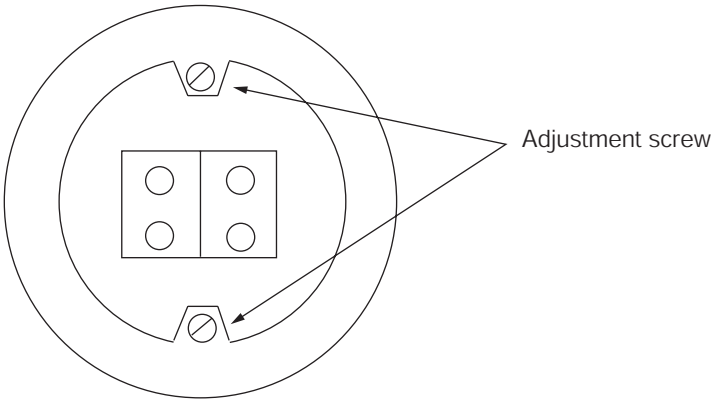
4) Assemble the removed parts in the reverse order.

6.2.12 Adjustment of the closing of slit

1) Remove the right and left covers of the lamp housing.
See 5.1.9 and 5.1.10.

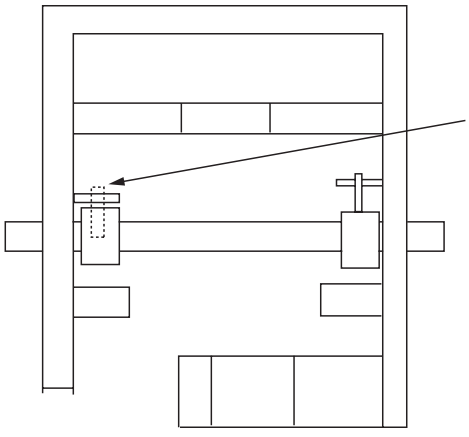
2) Turn the adjustment screw on the lower side of the lever while the diameter of cam is in the minimum position (the slit is fully closed) to adjust the position where the slit starts to be closed.
* Carefully tighten the screws so that the right and left sides become uniform.
When the knife edges start to be opened, slightly loosen the screws to close the knife edges.



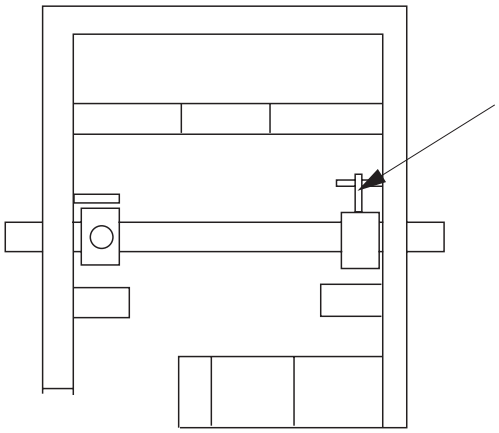


Lamp house BOTTOM

3) Adjust the position where the diameter of the cam becomes maximum (the slit is fully open/ variable according to the stopper position), and check how the slit opens (guide: 13mm).



4) Adjust the stopper position where the slit is fully closed.



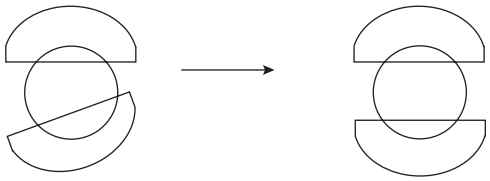
5) Go to 6.2.13.

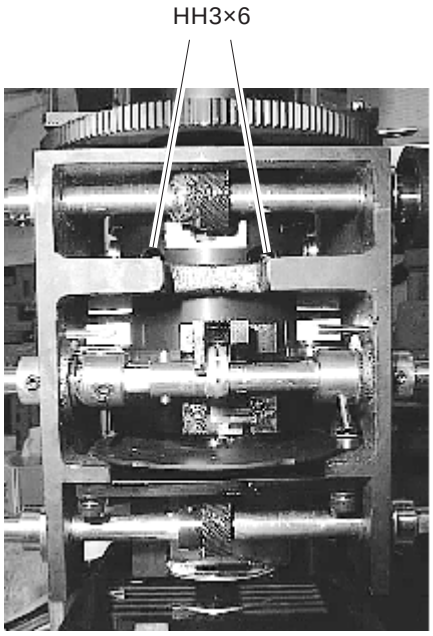
6.2.13 Check and adjustment of the horizontal slit image

1) Mount the focusing rod and set the magnification of microscope to 10×.

2) Make the slit image horizontal and long.

3) If the knife edges of the slit are not parallel, adjust with HH3 × 6.



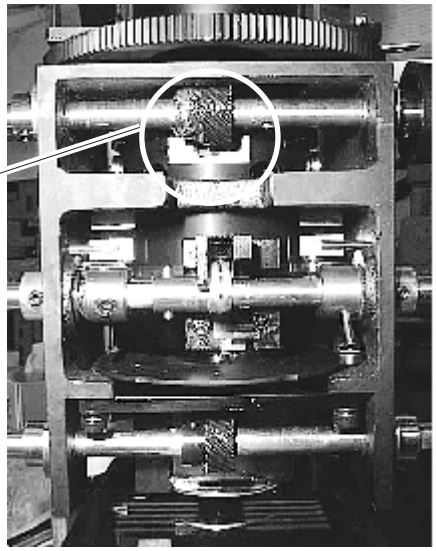


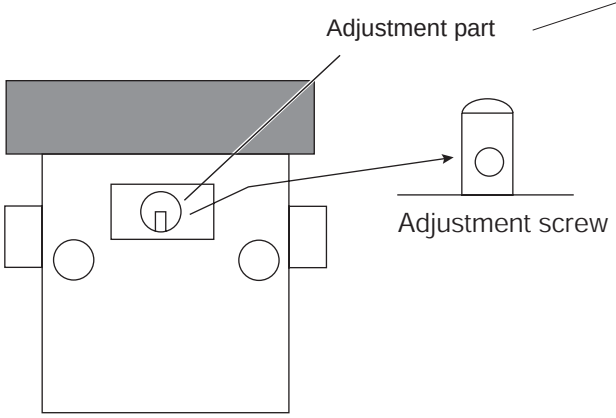
4) Verify the position where the slit starts to be closed.

5) Turn the slit image 180º and verify that the slit image position coincides with the position described in the step 4).

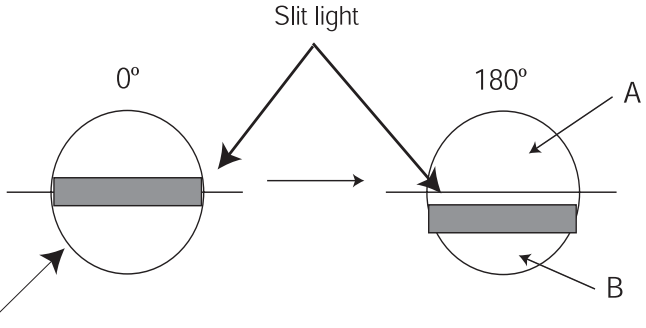
6) If the slit image position does not coincides with the position described in the step 4), adjust with the adjustment screw.

Turn the screw of the adjustment part with forceps to adjust the position of two knife edges of the slit.





(Adjustment method)



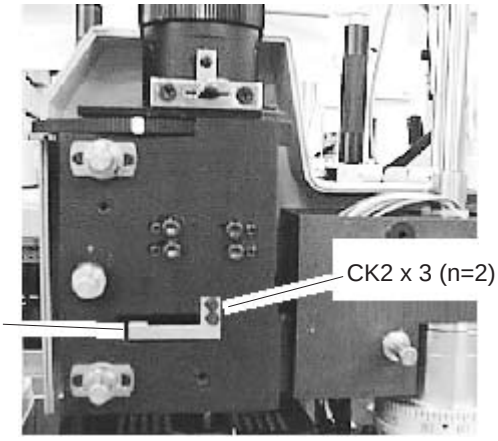
(Caution)
It seems to be upside-down on the focusing rod.

If the slit light is as shown in the figure:

- Open the knife edges by tightening the adjustment screw on A side.
- Loosen the adjustment screw on B side for fine adjustment to close the knife edges.
- After adjustment, verify that the slit starts to be opened from the center.

6.2.14 Check and adjustment of the vertical slit image

1) **Make the slit image vertical and long on the focusing rod, and verify that the slit image position coincides with the position where the horizontal slit image starts to be closed.**



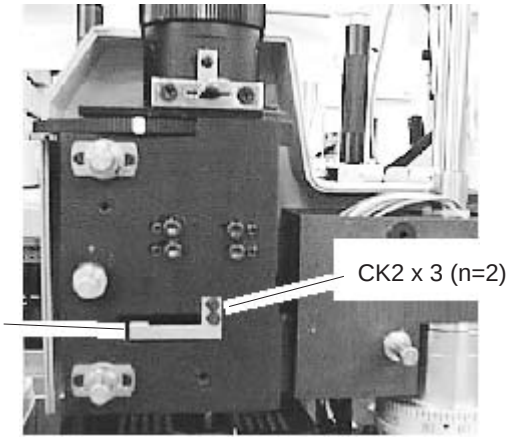
2) **If the slit image position does not coincides with the position where the horizontal slit image starts to be closed, loosen CK2 × 3.**
Adjust the aperture click position while striking a balance between the positions of illumination spot and knife edge so that the vertical and horizontal slit image positions where the slit starts to be closed become the same.

6.2.15 Adjustment of the slit shutter position (horizontal)

Follow the procedure below if the shutter position for spot size is ϕ1 or ϕ3 deviates from the center.

1) **Remove the right and left covers of the lamp housing.**
See 5.1.9 and 5.1.10.

2) **Slightly loosen CK2 × 3 (n=2).**

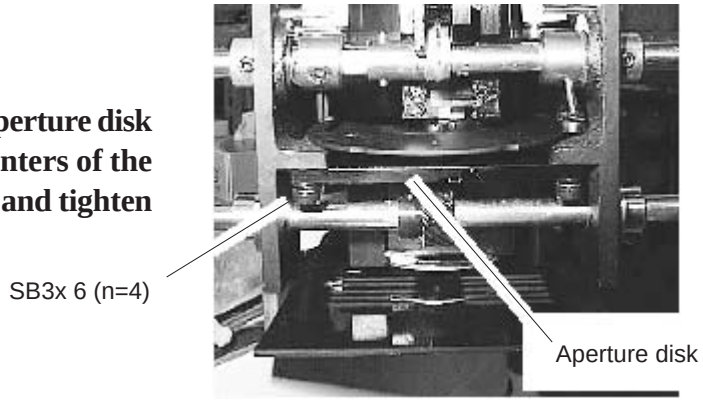


3) **Move the aperture click to the position where the positions of spot and shutter become the same, and tighten CK2 × 3 (n=2) to fix the aperture click.**

6.2.16 Adjustment of the slit shutter position (vertical)

1) **Remove the right and left covers of the lamp housing.**
   See 5.1.9 and 5.1.10.

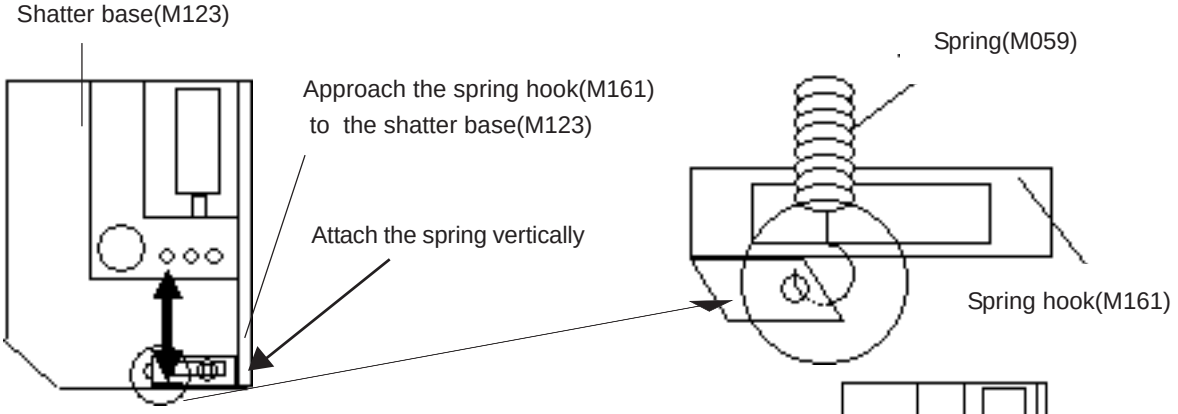
2) **Loosen SB3 × 6 (n=4) and move the aperture disk to the position where the rotation centers of the slit and knife edge become the same, and tighten SB3 × 6 (n=4).**



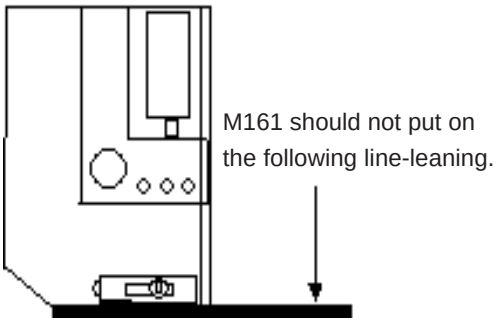
6.3 Adjustment of the aiming beam

6.3.1 Fixing the aiming shutter plate

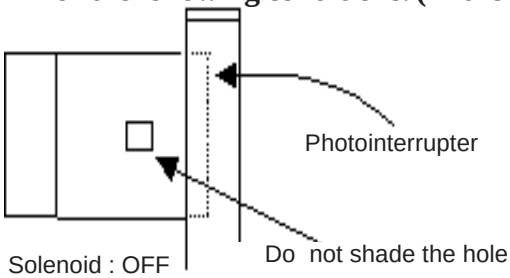
1) **Remove the aiming shutter ASSY.**
   See 5.18.
2) **The following illustrations are the attachment position of the spring (M059) and the spring hook (M161).**



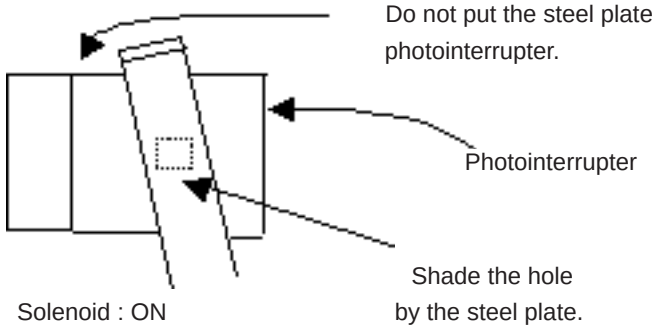
3) **Move M161 and adjust the solenoid operation. (M161 can be tilted, but do not get out of M123) Adjust the position of the solenoid and the photointerrupter for the following conditions. (In the order of 1 to 4.)**



1.

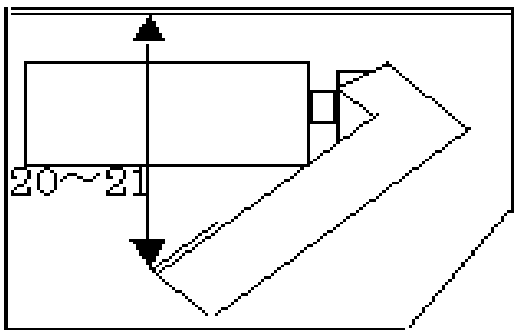


2.



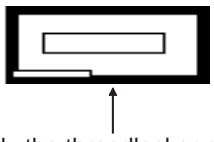
3. Get back the steel plate by the spring surely when the solenoid is off.

4. Working distance: 20-21mm
(If fulfill the conditions of 1.to 3., working distance can be over 21mm. Under 20mm is unacceptable.)



Power is on.

4) Apply the threadlocker around the steel plate of SB3x8[2], PC2x3[4] , SB3x5, and M161 after adjusting. Do not apply the threadlocker to the screw head of SB3x15. Apply the threadlocker to the outstanding side of M123.



Apply the threadlocker around the steel plate of M161.

5) Assemble the aiming shutter ASSY.

6.3.2 Check of the sensor for aiming shutter

1) Remove the aiming shutter ASSY.
See 5.18.

2) Connect the disconnected connector and turn ON the key switch.

3) Verify that 4th pin of J103 on the master board becomes as shown in the table below when the detection light is interrupted by inserting a board or metal plate into the slot of the sensor for the aiming shutter (1 position; PI3).

PI3	Interrupted	Not interrupted
4th pin of J103	High (DC5V)	Low (0V)

6.3.3 Adjustment of the optical axis of aiming beam

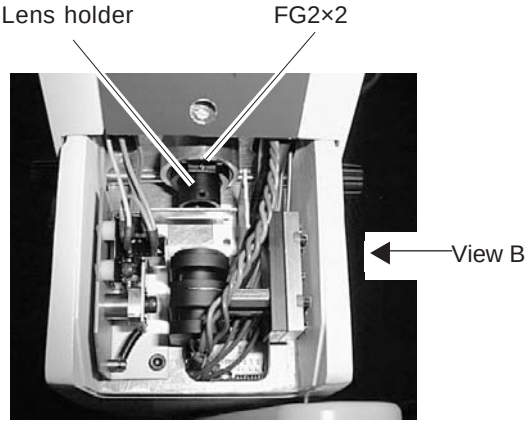
Refer to 5.6.3 of the operator's manual.

6.3.4 Focus adjustment of the aiming beam

1) **Put two aiming beam together on the focusing rod.**

2) **Loosen FG2 × 2 and turn the lens holder of the Beam aperture ASSY to obtain the focus.**

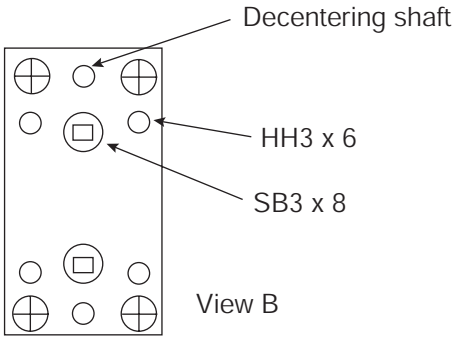
3) **After adjustment, tighten FG2 × 2.**



6.3.5 Adjustment of the optical axis of two-point aiming beams

1) **Turn the knob so that the two-point aiming beams become vertical.**

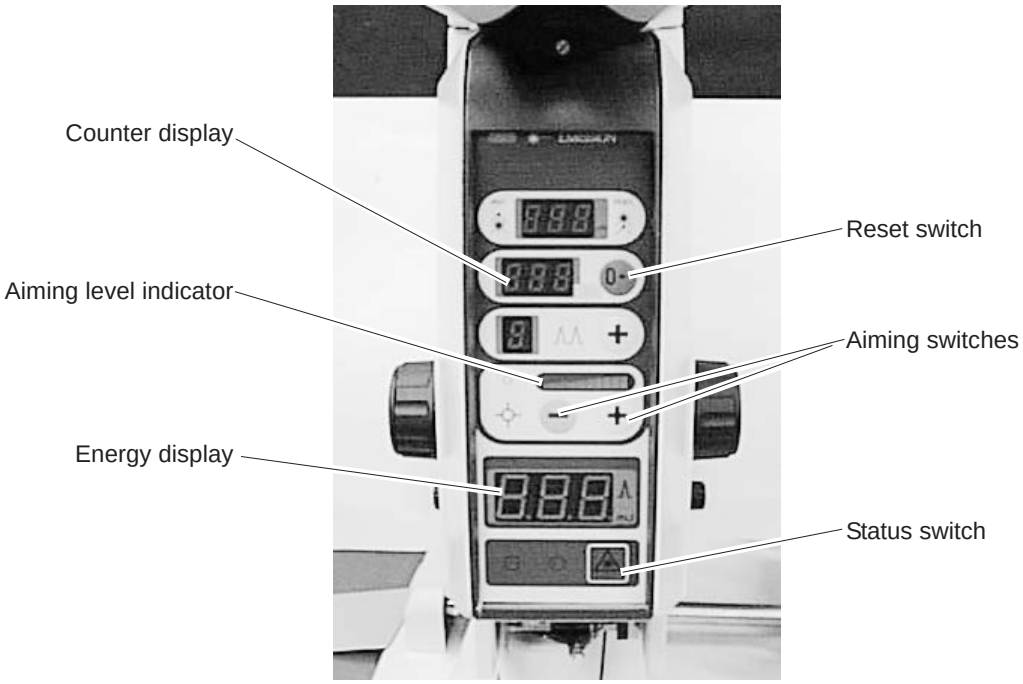
2) **Adjust the optical axis of the aiming beam.**
   - Horizontal direction:
     Tightening/loosening SB3 × 8 and HH3 × 6.
   - Vertical direction:
     Turning the lower decentering shaft.
   - Turn the upper decentering shaft to bring the brightness of two points into balance.



6.3.6 Adjustment of the aiming energy

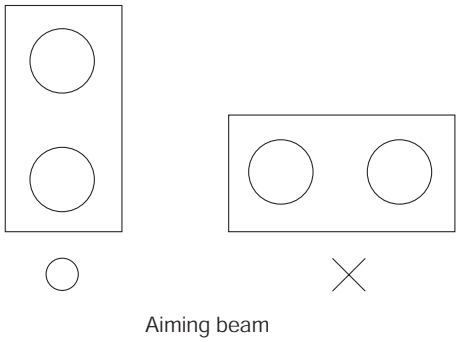
1) **Attach the power meter to the head rest support and set the detector of the power meter so that the aiming beam enters the detector.**

2) **Adjust the aiming energy.**
   See 6.3.7 and 6.3.8.



6.3.7 Adjustment of the maximum energy

1) **Adjust the VR1 on the control board ASSY so that the aiming energy becomes 25 ±5 µW when the bar graph of the aiming level indicator shows maximum by pressing the aiming switches.**
(The energy increases by turning the VR1 clockwise, and it decreases by turning the VR1 counterclockwise.)



• Be sure to make the aiming beam vertical at the time of the measurement.

Laser power meter

Range at the time of the maximum energy adjustment	
SUPPRESSION RANGE	-100 µW
METER RANGE	-100 µW × 1

2) **Go to 6.3.8.**

6.3.8 Adjustment of the minimum energy

1) **Check the energy at the time when the bar graph of the aiming level indicator shows minimum by pressing the aiming switches. If the energy is not 0.5 ±0.3 µW, perform followings.**

Laser power meter

Range at the time of the maximum energy adjustment	
SUPPRESSION RANGE	-10 µW
METER RANGE	-10 µW × 1

2) **Set No. 6 of SW1 on the display board ASSY to OFF (upper) position.**

3) **Set the address indicated on the counter display to "19" with the aiming switches.**

4) **Press the status switch so that the indications on the counter display blink.**

5) **Adjust the energy (starts from 100) by pressing the aiming switches (as the numeric value rises, the energy increases).**
After changing the numeric value, press the reset switch.
Make the aiming beam vertical at the time of the measurement.

6) **Set No. 6 of SW1 on the display board ASSY to ON (lower) position.**

* When the aiming power is maximum, check the voltage between TP-12 and GND of the control board ASSY is in under 0.9V with the taster. However if the voltage between 0.8 to 0.9V, check the dirt of optical system and the L.D.which is not vignetted.

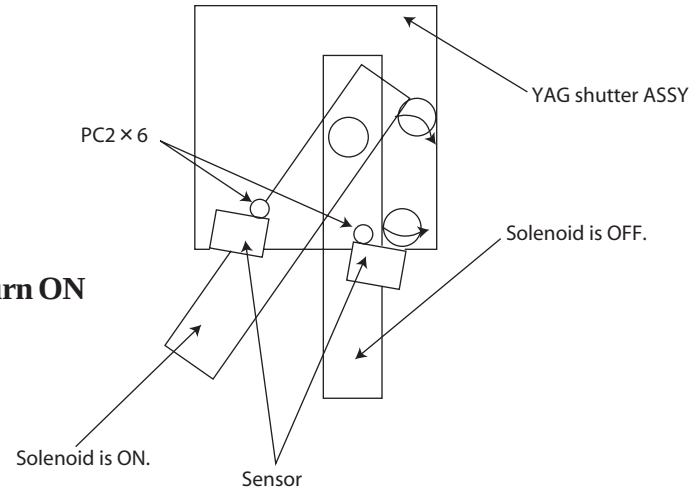
6.4 Adjustment of the YAG laser

6.4.1 Adjustment of the YAG shutter

1) **Remove the YAG shutter ASSY.**
   See 5.17.

2) **Loosen PC2 × 6 (n=2).**

3) **Connect the disconnected connector and turn ON the key switch.**



4) **Adjust the position of the detection sensor so that 5th and 6th pins of J102 on the master board become as shown in the table below when the YAG shutter is open or closed.**

	5th pin of J102	6th pin of J102
When the YAG shutter is open.	High (DC5V)	Low (0V)
When the YAG shutter is closed.	Low (0V)	High (DC5V)

5) **Tighten PC2 × 6 (n=2) and fix the detection sensor.**

6) **Assemble the YAG shutter ASSY.**

6.4.2 Check of the sensor for YAG shutter

1) Remove the YAG shutter ASSY.
See 5.17.

2) Connect the disconnected connector and turn ON the key switch.

3) Verify that 5th and 6th pins of J102 on the master board become as shown in the tables below when the detecting light is interrupted by inserting a board or metal plate into the slot of the sensor for the YAG shutter (2 positions; PI1 and PI2).

	PI1	
	Interrupted	Not interrupted
6th pin of J102	High (DC5V)	Low (0V)

	PI2	
	Interrupted	Not interrupted
5th pin of J102	High (DC5V)	Low (0V)

6.4.3 Adjustment of the indicated and measured values of PFN voltage

Perform the adjustment of the indicated and actual values of the PFN voltage when the YL POWER SUPPLY board is replaced.

1) Remove the front cover.
See 5.1.1.

2) Remove the microscope arm cover.
See 5.1.4.

3) Turn the VR1 on the YL power supply board counterclockwise ten turns or more.

4) Turn ON the key switch.

5) Set No. 1 and 6 of SW1 on the display board ASSY to OFF (upper) position.

6) Set No. 1 of SW1 on the display board ASSY to ON(lower) position, and then check the actual PFN voltage is 350 ± 10V.

7) Set the address indicated on the counter display to "10" by pressing the aiming switches.
[Setting of the system parameter]

Address	Contents	Initial setting
10	PFN voltage	350

8) Press the status switch to blink the indications on the energy display.

9) Set the indications on the energy display to "440" by pressing the aiming switches.

10) Press the reset switch.

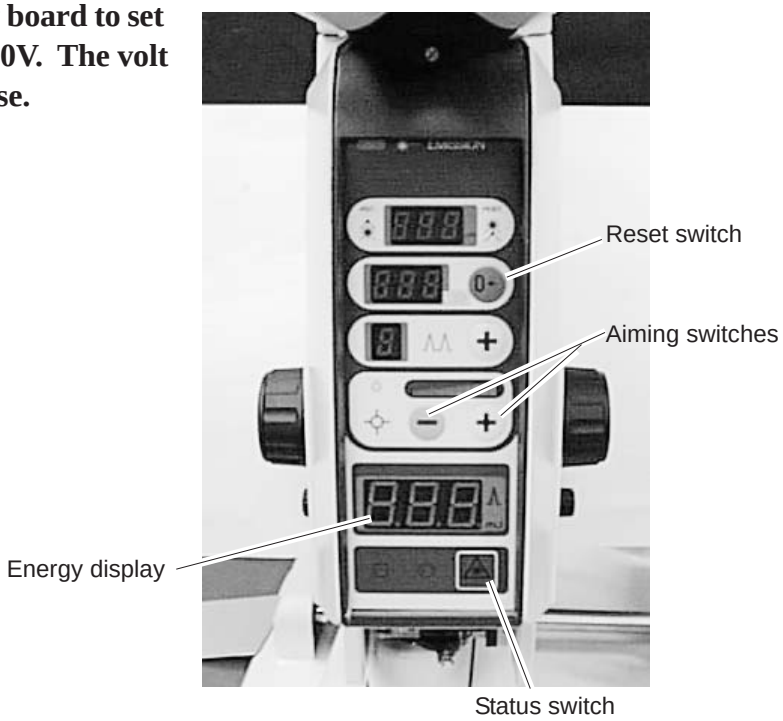
11) Set No. 1 and 6 of SW1 on the display board ASSY to ON (lower) position.

12) Set No. 7 of DIP SW1 to OFF (upper) position. The PFN voltage (monitored value) is indicated.

13) Connect the digital multi meter between 1st (+) and 5th (-) pins of P2 on the YL power supply board.

14) Turn the VR1 on the power supply board to set the actual PFN voltage to 440V±10V. The volt age is raised by turning it clockwise.

15) Go to 6.4.4.



6.4.4 Adjustment of the PFN voltage

1) **Set No. 1 and 6 of SW1 on the display board ASSY to OFF (upper) position.**

2) **Set the address indicated on the counter display to "10" by pressing the aiming switches.**

3) **Press the status switch to blink the indications on the energy display.**

4) **Set the numeric value indicated on the energy display to "350" by pressing the aiming switches.**

5) **Press the reset switch.**

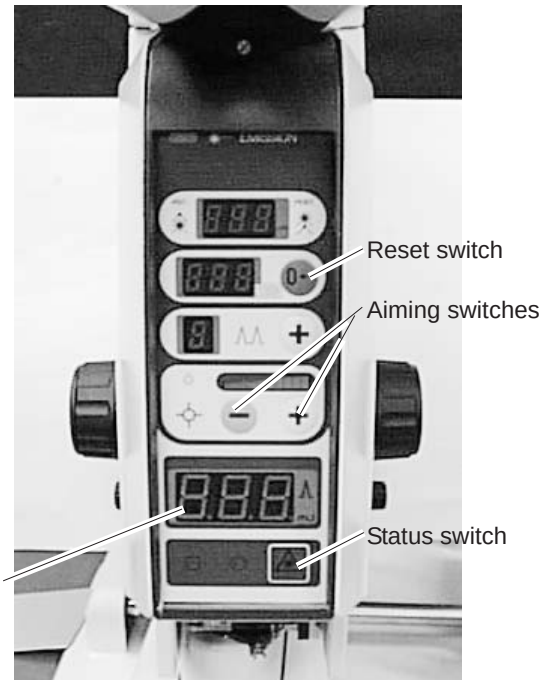
6) **Set No. 1 of SW1 on the display board ASSY to ON (lower) position and then check the actual PFN voltage is 350 ± 10V.**

7) **Set the address indicated on the counter display to "11" by pressing the aiming switches.**

8) **Press the status switch to blink the indications on the energy display.**

9) **Set the numeric value indicated on the energy display to "02" by pressing the aiming switches.**

10) **Press the reset switch.**



11) **Set No. 1 and 6 of SW1 on the display board ASSY to ON (lower) position.**

12) **"C. A. L" is indicated on the focus shift display and the PFN voltage is automatically adjusted.**
At this time, the PFN voltage is indicated on the energy display, and the actual number of pulses is indicated on the counter display. The PFN voltage adjustment is automatically performed until the number of pulses becomes 4 in 8 shots or more out of 10 shots.

13) **"C. A. L" indication on the focus shift display disappears and the PFN voltage adjustment is finished.**

14) Set No. 6 of SW1 on the display board ASSY to OFF (upper) position.

15) Set the address indicated on the counter display to “10” by pressing the aiming switches.

16) Press the status switch to blink the indications on the energy display.

17) Correct the numeric value indicated on the energy display with the aiming switches following the standard below.

[Standard]

① When the room temperature is 25ºC or more:
The automatic setting PFN voltage + 5

② When the room temperature is 20ºC or less:
The automatic setting PFN voltage - 5

③ When the room temperature is more than 20ºC and less than 25ºC:
No additional adjustment

18) Press the status switch to blink the indications on the counter display.

19) Set the address indicated on the counter display to “11” by pressing the aiming switches.

20) Press the status switch to blink the indications on the energy display.

21) Set the numeric value indicated on the energy display to “00” by pressing the aiming switches.

22) Press the reset switch.

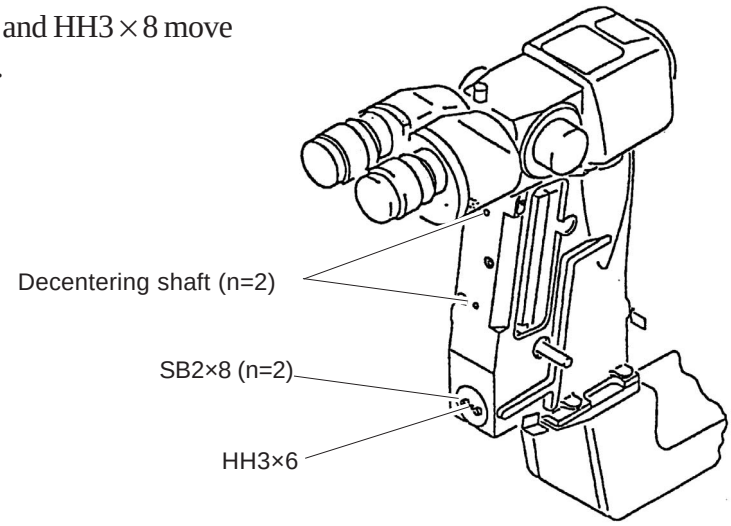
23) Set No. 6 of SW1 on the display board ASSY to OFF (upper) position.

6.4.5 Adjustment of the mirror holder 3 and optical axis of YAG laser head

1) **Stick the burn paper on the head rest and manipulate the joystick so that the aiming beam is brought into focus on the burn paper.**

2) **Adjust the decentering shaft (n=2) and SB2 × 8 (n=2) and HH3 × 8 of mirror holder 3 so that the spot where the aiming beam is emitted on the burn paper burns when the YAG laser beam is emitted.**
   * To adjust the decentering shaft, slightly loosen SB3 × 6 (n=3) which fix the YAG laser unit first.
   * The decentering shaft moves the YAG laser beam horizontally, and SB2 × 8 (n=2) and HH3 × 8 move the YAG laser beam vertically.

3) **Go to 6.4.6.**



6.4.6 Adjustment of the focus ASSY

1) **Stick the burn paper on the head rest and manipulate the joystick so that the aiming beam is brought into focus on the burn paper.**

2) **Adjust followings so that the spot where the aiming beam is emitted on the burn paper burns when the YAG laser beam is emitted.**
   Vertical direction: Adjust the attachment position of the focus ASSY.
   Horizontal direction: Turn the decentering shaft (n=2) and adjust the direction of the laser head.
   * To adjust the decentering shaft, slightly loosen SB3 × 6 (n=3) which fix the YAG laser unit first.

3) **Go to 6.4.7.**

6.4.7 Adjustment of the D mirror ASSY (aligning the YAG laser beam to the aiming beam)

Refer to 5.6.4 of the operator's manual.

6.4.8 Adjustment of the focus of YAG laser

Perform this procedure after the adjustment of the optical axis of YAG laser head (6.4.5).

• Alignment of 0µm

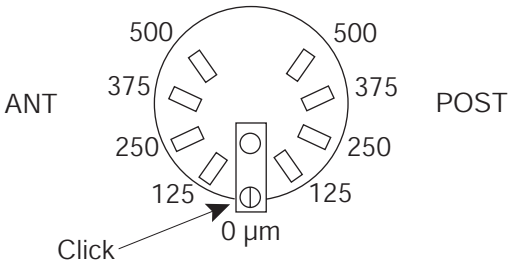
1) Set the numeric value indicated on the focus shift display to "0".

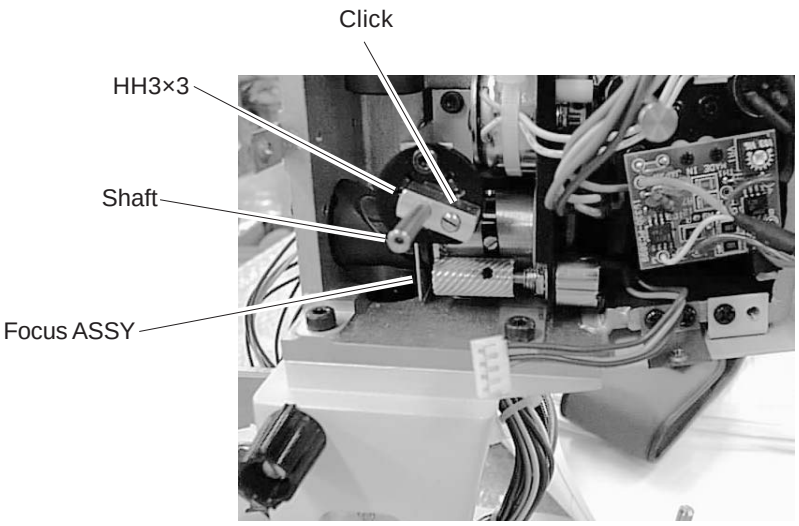
2) Bring the aiming beam into focus on the burn paper.

3) Turn the click so that the burnt pattern becomes minimum when the YAG laser beam is emitted.

4) Loosen HH3 × 3 paying attention not to move the shaft, and tighten HH3 × 3 while the click is in a downward position.

5) Go to 6.4.9.

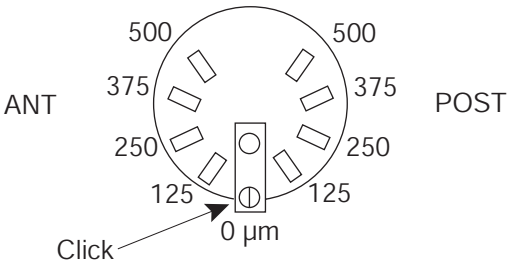




6.4.9 Adjustment of the focus shift

Perform this procedure after Alignment of 0µm.

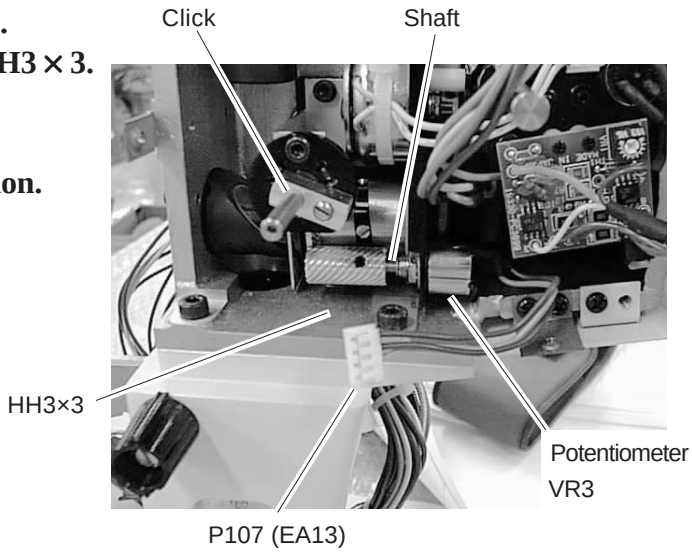
1) Turn the click to 0µm position.



2) a. Set No.1 and 6 of SW1 on the display board ASSY to OFF (upper) position and the parameter adress to any one of the numbers from 40 to 48.

b. Loosen HH3 × 3 and turn the shaft so that the value of energy becomes 130 ±10 while the focus shift is set to 0 position.

c. After adjustment, tighten HH3 × 3.



3) Turn the click to ANT 500 position.

4) Set the address indicated on the counter display to "40" by pressing the aiming switches.

5) Press the reset switch.

6) Determine the position of the focus shift between ANT375 and POST 500 with the following adresses and press the reset switch.

Focus shift	ANT 500	375	250	125	0	125	250	375	POST 500
Set address	40	41	42	43	44	45	46	47	48

7) When all settings are completed, set No. 1 and 6 of SW1 on the display board ASSY to ON (lower) position.

6.4.10 Adjustment of the YAG laser energy

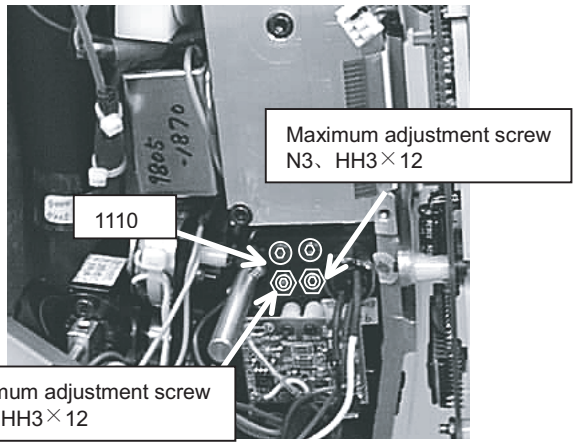
Perform this procedure after the adjustment of the optical axis of YAG laser head (see 6.4.5) and adjustment of the focus of YAG laser (see 6.4.8).

• Adjustment of the actual energy (maximum)

1) Set the detector in order that the aiming beam shall go into it.
<Note> If the energy that the acceptance surface of the detector recieves is too dense, the detector might be damaged. Keep the aiming beam as big as possible in order that the YAG laser beam shall not focus on the acceptance suface.

2) Loosen the right nut (N3) and adjust HH3×12 in order that the actual energy measured with energy meter shall be about 11mJ when the energy amount of the YAG laser is maximum.

3) Tighten the nut (N3). Be careful not to tighten HH3×12.



• Adjustment of the actual energy (minimum)

1) Loosen the left nut (N3) and adjust HH3×12 in order that the actual energy measured with the energy meter shall be about 0.2mJ when the energy amount of the YAG laser is minimum.

2) Tighten the nut (N3). Be careful not to tighen the HH3×12.

• Adjustment of the YAG laser indicated energy 10mJ

1) Attach the detector of the energy meter to the chinrest.
CAUTION) When using the energy meter MODEL-365, attach a dispersion lens in front of the objective lens.

2) Adjust the chinrest and manipulate the joystick so that the aiming beam comes into the detector.

3) Emit the YAG laser beam and turn the energy control so that the actual energy becomes 10mJ.

4) Turn the VR1 on the sample board so that the indicated energy shows 10mJ under the condition of the step 3).
[Specification]
Difference between the actual energy and indicated energy (10mJ):
Within ±15% of the indicated energy

• Adjustment of the YAG laser indicated energy 1mJ

1) Attach the detector of the energy meter to the chinrest.
CAUTION) When using the energy meter MODEL-365, attach a dispersion lens in front of the objective lens.

2) Adjust the chinrest and manipulate the joystick so that the aiming beam comes into the detector.

3) Emit the YAG laser beam and turn the energy control so that the actual energy becomes 1mJ.

4) Set No. 1 and 6 of SW1 on the display board ASSY to OFF (lower) position under the condition of the step 3).

5) Set the address indicated on the counter display to "20" by pressing the aiming switches.

6) Press the status switch to blink the indications on the energy display.

7) Adjust the parameter indicated on the energy display within the following standard with the aiming switches.
[Specification]
Difference between the actual energy and indicated energy (1mJ):
within ±15 % ±0.1mJ of indicated energy
• If the actual energy is larger than the indicated energy, increase the set value, and decrease the set value if the actual energy is smaller than the indicated energy.

8) Press the reset switch.

9) Set No. 1 and 6 of SW1 on the display board ASSY to ON (lower) position.

• Setting of preset data

1) Set No. 1 and 6 of SW1 on the display board ASSY to OFF (upper) position.

2) Turn the energy control to Min. position.

3) Turn ON the key switch while the status switch is pressed.

4) Emit 10 shots of the YAG laser beam while the energy is set to Min.

5) Press the reset switch.

6) Perform the adjustment for the energy, 1, 3, 5, 7.5, and Max. in a like manner.

7) Turn OFF the key switch.

8) Set No. 1 and 6 of SW1 on the display board ASSY to ON (lower) position.

9) Turn ON the key switch again.

10) Turn the energy control to Max. position.

11) Emit 10 shots of the YAG laser beam in SINGLE mode and press the reset switch.

12) Emit 10 shots of the YAG laser beam in DOUBLE mode and press the reset switch.

13) Emit 10 shots of the YAG laser beam in TRIPLE mode and press the reset switch.

14) Turn OFF the power.

15) Turn ON the power again.

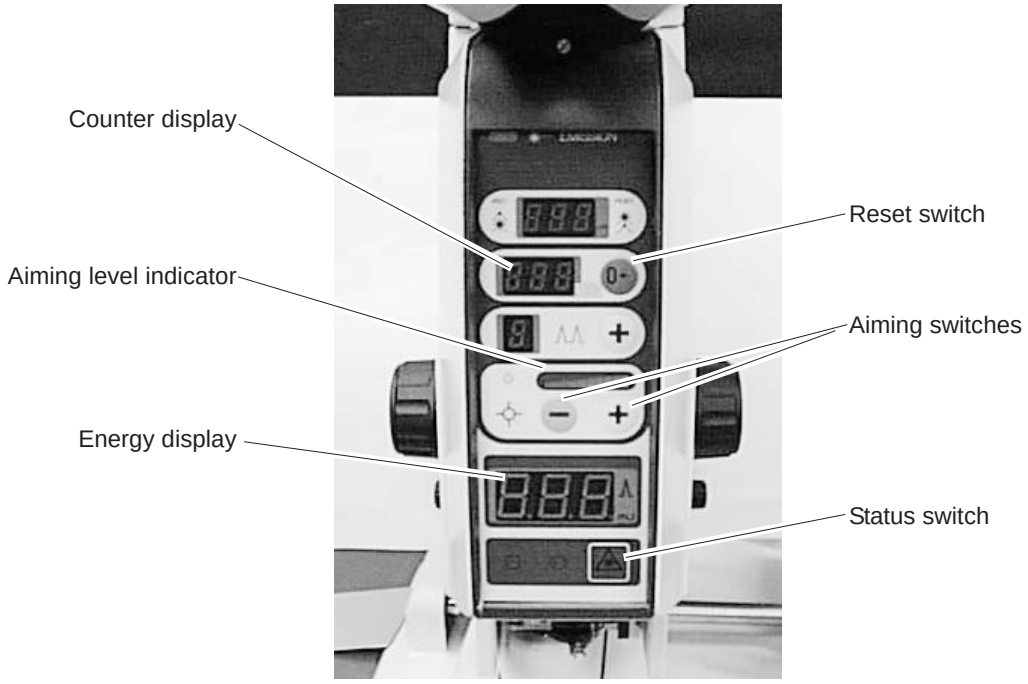
16) Turn the energy control to Min. position.

17) Attach the detector of the energy meter to the chinrest.

18) Adjust the chinrest and manipulate the joystick so that the aiming beam comes into the detector.

19) Emit 10 shots of the YAG laser beam and verify that the difference between the actual energy and indicated energy for the 10th shot is within the following specifications. (Measure the energy in SINGLE, DOUBLE, and TRIPLE mode.)

If the measured result is out of the spec, go to the next step.
Perform this verification for the energy, 1, 3, 5, 7.5, and Max.



• Specifications of variability between the indicated energy and actual energy

① Less than 1.5mJ	→	±15% of 0.1mJ
② 1.5mJ or more	→	±15%

20) Set No. 1 and 6 of SW1 on the display board to OFF (upper) position.

21) Set the address indicated on the counter display as described in the following table by pressing the aiming switches.

22) Press the status switch to blink the indications on the energy display.

23) Change the system parameter so that the difference between the actual energy and indicated energy meets the specifications as described above.

[System parameter setting]

Address	Contents	Initial setting
30	Preset potential Min.	35
31	Preset potential 1mJ	50
32	Preset potential 3mJ	70
33	Preset potential 5mJ	85
34	Preset potential 7.5mJ	100
35	Preset potential Max.	125

24) Repeat steps 18) to 23) until the actual energy becomes the same as the indicated energy.

25) Press the reset switch.

26) Set No. 1 and 6 of SW1 on the display board to ON (lower) position.

6.5 Other adjustments

6.5.1 Adjustment of the smoothness of vertical movement

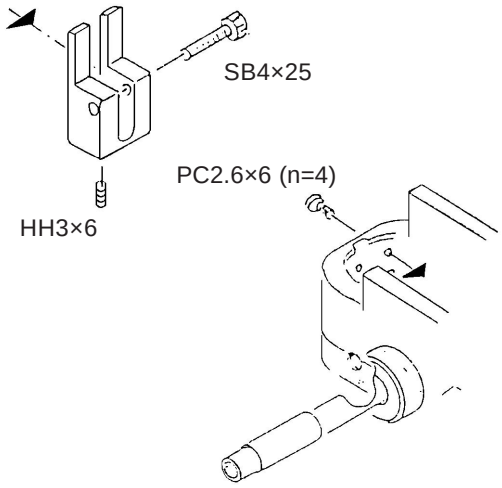
1) **Loosen PC2.6 × 6 (n=4) and verify that the vertical movement becomes smooth.**

2) **If the movement is smooth, tighten PC2.6 × 6 (n=4). If not, tighten PC2.6 × 6 (n=4) and go to step 3).**

3) **Dismount the slit lamp from the base plate and loosen HH3 × 6 which is for the prevention of runout.**

4) **Loosen SB4 × 25 approx. one-fourth turn.**

5) **Tighten HH3 × 6.**



6.6 Adjustment of indicated energy from outside of the device and settable function

6.6.1 Adjustment of indicated energy of YAG laser

6.6.1.1 Gain adjustment

e.g.) If the actual energy is 11mJ and indicated energy is 10mJ, increase the indicated value 10%. In this case, set the parameter value to set energy × 110. (If the set value is "100", reset it to "110". To decrease 10%, reset it to "90".)

1) **Turn on the key switch while pressing "Aiming ∆∇ " and "READY".**

2) **After starting the device, set the adress to 18 (y H) and adjust the set energy.**

3) **Restart the device and check the actual energy.**

6.6.1.2 Offset adjustment

e.g.) If the actual energy is 1.0mJ and indicated energy is 0.8mJ, increase the indicated energy 0.2mJ. In this case, reset the parameter to set energy +2. (If the set value is "10", reset it to "12". To decrease 0.2mJ, reset it to "8".

1) **Turn on the key switch while pressing "Aiming ∆∇ " and "READY".**

2) **After starting the device, set the adress to 20 (y H) and adjust the set energy.**

3) **Restart the device and check the actual energy.**

6.6.2 Adjustment of aiming energy

6.6.2.1 Aiming gain adjustment

e.g.) If the maximum actual energy of aming is nonstandard (standard:25 μW±5μW), change the parameter value and adjust the actual energy of the aiming laser.(If the actual energy is higher than the standard, decrease the parameter value. If lower, increase it.)

1) **Turn on the key switch while pressing "Aiming ∆∇ " and "READY".**

2) **After starting the device, set the adress to 17 (A H) and adjust the set energy.**

3) **Restart the device and check the actual energy.**

6.6.2.2 Aiming offset adjustment

e.g.) If the minimum actual energy of aimning is nonstandard (standard:0.5 μW±0.3μW), change the parameter value and set the actual energy of the aming laser. (If the actual energy is higher than the standard, decrease the parameter value. If lower, increase it.)

1) Turn on the key switch while pressing "Aiming ΔV " and "READY".

2) After starting the device, set the adress to 19 (A L) and adjust the set energy.

3) Restart the device and check the actual energy.

6.6.3 Release of tilting lens-barrel (option) control

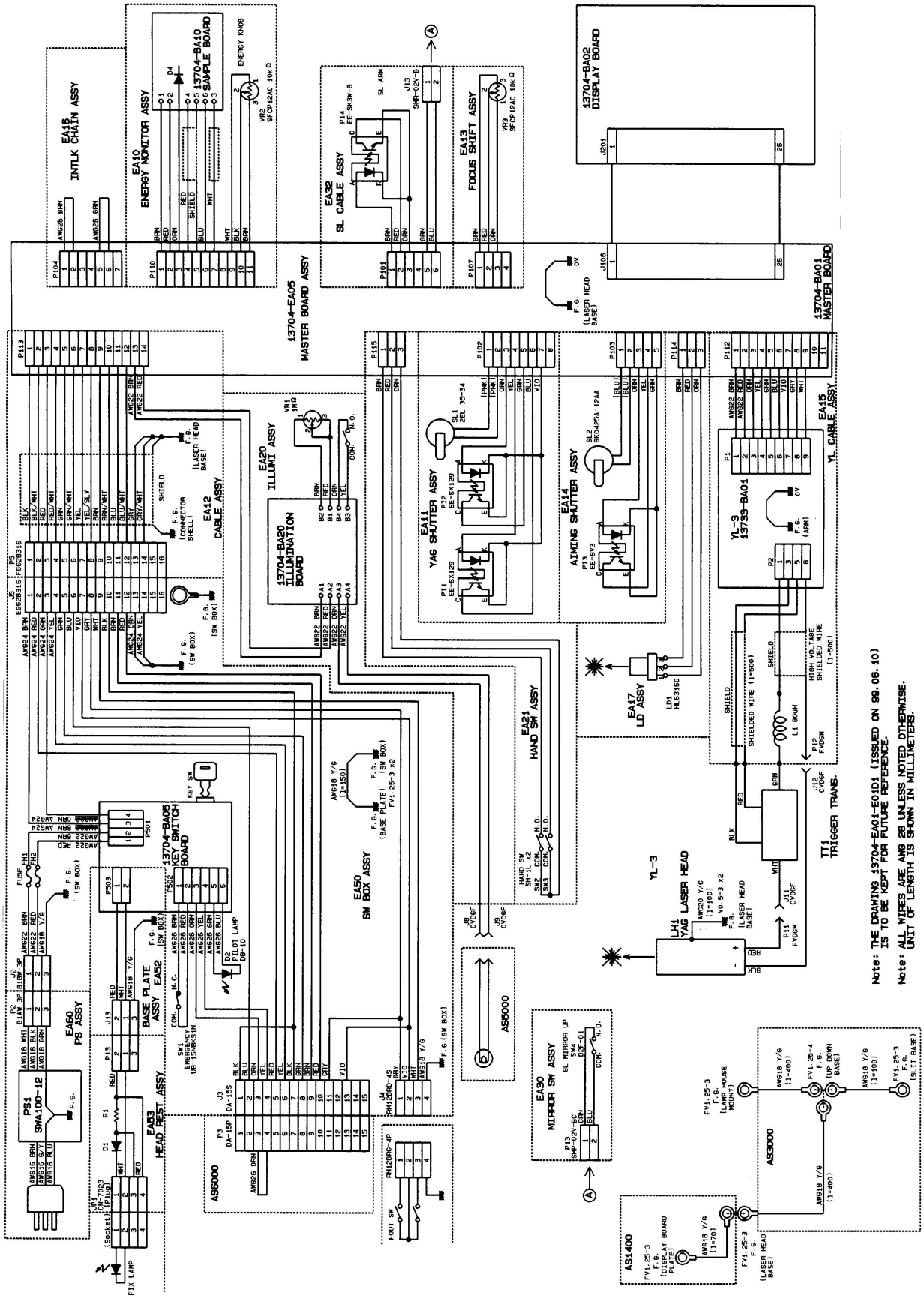
If the tilting lens-barrel is set in front of the laser output with the barrel lifted, YAG laser strikes the lighting lens-barrel, which may cuase a difference between indicated energy and actual energy. So as YC-1300/1400, the safty function that controls YAG laser emission at the point where laser beam strikes is equiped. This control can be released by following the procedures below.

<Note> In this case, enough warning shall be given to the user before use because when the lens-barrel is move, the actual energy may change considerably even without changing the setting.

This function is not memorized and when the device is restarted, the safty function will work again.

1) Turn on the key switch while pressing "RESET".

§7 WIRING DIAGRAM



§8 ERROR CODE LIST

Error code and dip switch of the YC-1600 are as follows.

8.1 Error code list

Error No.	Symptom	Cause
1	The internal structures of the system have been overheated.	The inside temperature is 45°C or more.
4	The EEPROM is faulty.	Failure of the EEPROM
5	The safety shutter does not work.	Failure of the safety shutter or sensor.
7	The aiming shutter does not work.	Failure of the aiming shutter or sensor
10	The number of pulse is insufficient.	Failure of the YAG laser or detection circuit
12	The number of pulse is over the intended number.	Failure of the YAG laser or detection circuit
13	The laser beam is accidentally emitted through the trigger switch is not pressed.	Failure of the YAG laser or trigger circuit
14	The laser head is faulty.	Failure of the YAG laser or trigger circuit
15	The output energy of the laser beam is unstable.	Failure of the YAG laser or detection circuit
30	The power supply for the laser is faulty.	Failure of the power supply for YAG laser
31	The PFN voltage is faulty.	Failure of the power supply for the YAG laser
50	Signal from the photodiode is faulty.	Break of failure of the photodiode for detecting the YAG laser output energy
51	The potentiometer for adjusting the output energy is broken.	Break or failure in the potentiometer for adjusting the YAG laser output energy
52	The potentiometer for adjusting the focus shift is broken.	Break or failure in the potentiometer for adjusting the focus shift
53	The trigger switch inputting signal is faulty	Failure of the trigger switch inputting signal circuit
54	The pulse number setting signal is faulty.	Failure of the pulse number setting signal circuit
90	The program is faulty.	The contents of ROM are overwritten.

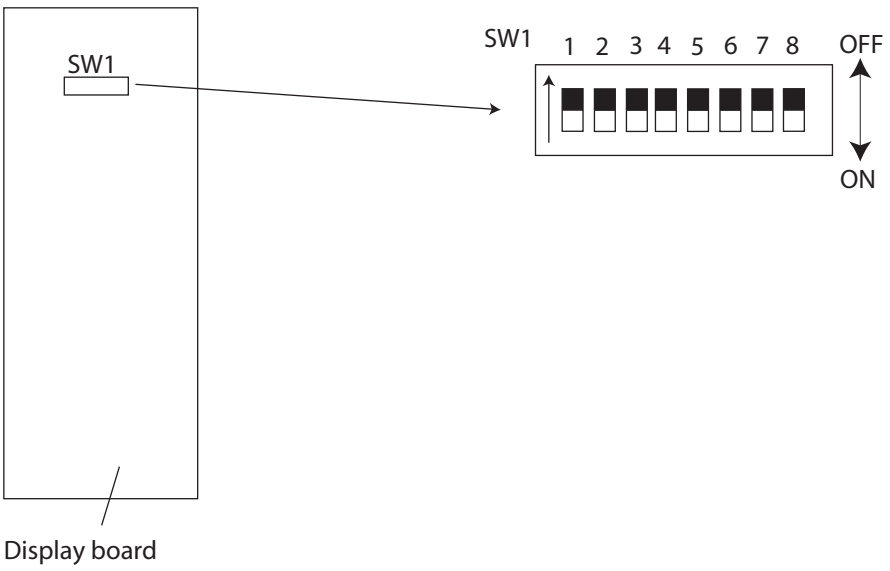
8.2 Dip switch list

Normally, all dip switches (SW1) on the display board are set to "ON" (lower position). The following operations are performed by setting them to "OFF" (upper position).

[CAUTION] Set all switches to "ON" after the service. If any switches remain "OFF", "D. P. (Decimal Point)" appears on the counter display.

When all switches are "ON" ... "1 2 3 4"
When any switches are "OFF" ... "1. 2. 3. 4."

No.	Operation	Details
1	Error cancel mode	Cancels the detection of error. In the case of Error 1, the laser cannot be emitted even in the error cancel mode.
2	Not used	
3	Not used	
4	Not used	
5	Not used	
6	Parameter setting mode	Each parameter can be set. (As for the contents of each parameter, refer to § 10.)
7	PFN voltage (monitored value) indication	PFN voltage (monitored value) is indicated on the energy display.
8	Not used	



8.3 Other indications

If any problem occurs when handling each switch, the following abbreviations are indicated on the focus shift display.

"A. P." ..... appears when the status switch is pressed though the aiming beam is set to OFF.
Set the aiming beam to ON.

"S. S." ..... appears when the foot switch is pressed though the status indicator for STANDBY mode lights.
Press the status switch.

"S. L." ..... appears when the position of the illumination tube is improper or the YAG laser beam is interrupted.
Set the position of the illumination tube so that the YAG laser beam can be emitted.

"H. S." ..... appears when it is neccessary to select the hand switch.

"F. S." ..... appears when it is neccesary to select the foot switch.

§9 SYSTEM PARAMETER LIST

This section describes the system parameters of the YC-1600.

The EEPROM is built in the YC-1600 to store data at the time of the adjustment.
By changing the data (hereafter called parameter), for example, it is possible to change the laser output energy, timing of opening/closing of each shutter and various settings.

9.1 Changing and setting of the parameters

1) Remove the front cover.
See 5.1.1.

2) Turn ON the key switch.

3) Set No. 6 of SW1 on the display board to OFF (upper) position.
Each data appear on the following display when No. 6 is set to OFF.

Counter display on the control panel:	Address of parameter
Focus shift display on the control panel:	Abbreviation of parameter
Energy display on the control panel:	Setting value of parameter

4) Press the aiming switches to indicate the address of parameter (on the counter display) to be changed.

5) Press the status switch to blink the setting value of parameter (on the energy display).

6) Press the aiming switches to change the setting value of parameter (on the energy display).

7) Press the reset switch (at this time, verify that the beep sound can be heard.).

8) Set No. 6 of SW1 on the display board to ON (lower) position.
[CAUTION] It is necessary to turn the key switch to the ON position again except when the laser output energy and timing of opening/closing each shutter are changed.

9.2 Original setting of the system parameters

Caution) It is necessary to set the necessary data because all data is initialized.

1 Remove the front cover.
See 5.1.1.

2) Turn ON the key switch.

3) Turn OFF (upper position) No. 6 of the SW 1 on the display board ASSY.

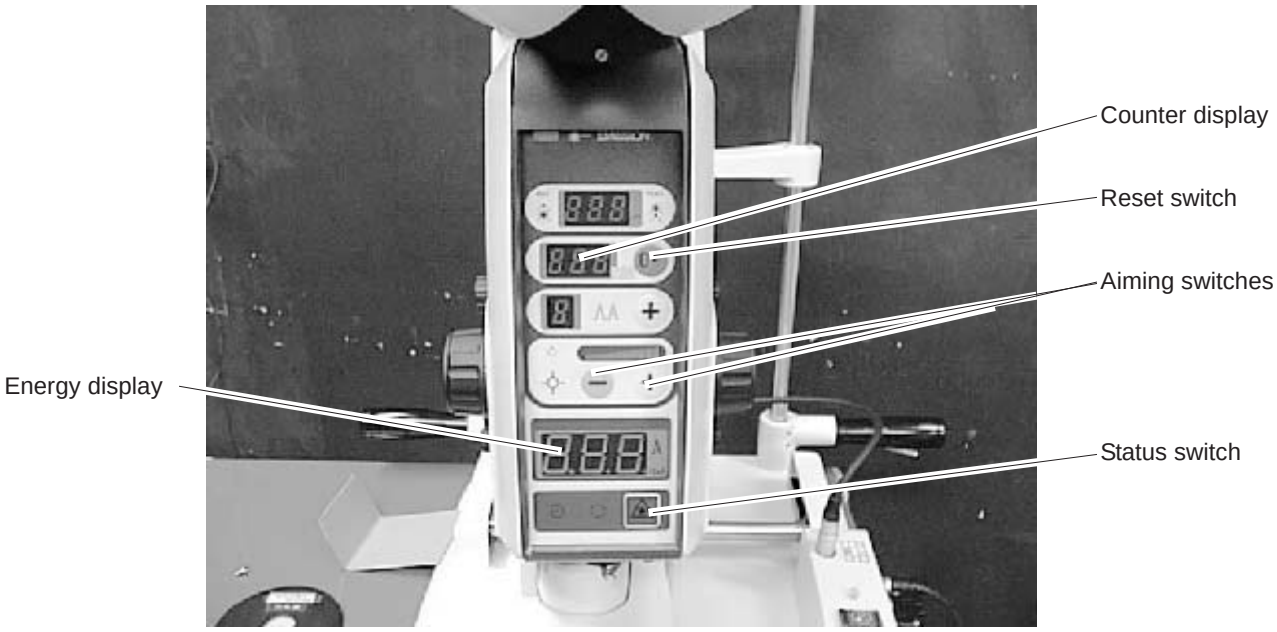
4) Set the address indicated on the counter display to “99” by pressing the aiming switches.

5) Press the status switch so that the indications on the counter display blink.

6) Set the address indicated on the counter display to “999” by pressing the aiming switches.

7) Press the Reset switch to determine the setting of address. (At this time, the beep sound is heard.)

8) Turn ON (lower position) No. 6 of the SW 1, and turn OFF the key switch.



9.3 Contents of parameters

Address	Abbreviation	Initial setting	Details
1	AdJ	00	Control of the adjustment mode 0: Normal mode 1: Adjustment mode
2	AL	00	Control of the sound of the laser shot 0: Sound 1: No sound
3	dEL	00	Not used
4	cnt	10	Countdown timer (Not used at present)
5	toc	00	Total counter operation stop 0: Operation 1: Stop
6	n-A	00	Not used
7	rdy	02	Automatic OFF of READY mode 0: OFF 1-: Value ¥minute
8	Ccl	01	Memory of the counter 0: Memory 1: Clear
9	Acl	0	Memory of the aiming beam 0: Memory 1: Clear
10	PFn	350	PFN voltage
11	CAL	00	Adjustment mode of the PFN voltage 0: OFF 1: After Err 10 2: Forced
12	FSc	00	Checking the focus shift at the time of starting 0: OFF 1: ON (with beep sound) 2: ON (without beep sound)
13	trS	01	Prohibition of switching the trigger switch form outside 0: Prohibited 1: Permitted
14	HF	00	Switching of the trigger switch 0: HAND SW 1: FOOT SW
15	tr2	01	Input switch of the trigger switch 0: 2 circuits 1: 1 circuit
16	2dl	00	Not used
17	A-H	100	Gain of the software for aiming
18	YH	100	Gain of the software for energy
19	AL	100	Offset of the aiming
20	YL	10	Offset of the energy 10=± 0mJ

Address	Abbreviation	Initial setting	Details
21	PrS	100	Correction factor for present SINGLE
22	Prd	100	Correction factor for present DOUBLE
23	Prt	100	Correction factor for present TRIPLE
24	PrF	100	Correction factor (spare)
25	PrP	100	Correction factor (spare)
26	Err	00	Memory of last ERR value
27	cod	00	Memory of last counter value
28	tco	115	Memory of total counter value
29	Ad	00	Memory of aiming value
30	PPL	35	Preset Min.
31	PP1	50	Preset 1mJ
35	PP3	70	Preset 3mJ
33	PP5	85	Preset 5mJ
34	PP7	100	Preset 7.5mJ
35	PPH	125	Preset Max.
36	n-A	100	Not used
37	n-A	100	Not used
38	n-A	100	Not used
39	n-A	100	Not used
40	F-5	70	Focus shift –500
41	F-3	85	Focus shift –375
42	F-2	105	Focus shift –250
43	F-1	125	Focus shift –125
44	F0	145	Focus shift 0
45	F1	165	Focus shift +125
46	F2	185	Focus shift +250
47	F3	205	Focus shift +375
48	F5	225	Focus shift +500
49	n-A	00	Not used
50	brt	30	Software blinking time
51	ruS	250	The number of shutters at the running
52	ruF	10	The number of shots at running ×100

Address	Abbreviation	Initial setting	Details
53	n-A	00	Not used
54	n-A	00	Not used
55	n-A	100	Not used
56	n-A	100	Not used
57	n-A	100	Not used
58	n-A	100	Not used
59	n-A	100	Not used
60	PEL	02	Present ENERGY DATA Min.
61	PE1	10	Present ENERGY DATA 1mJ
62	PE3	30	Present ENERGY DATA 3mJ
63	PE5	50	Present ENERGY DATA 5mJ
64	PE7	75	Present ENERGY DATA 7.5mJ
65	PEH	110	Present ENERGY DATA Max.
66	n-A	00	Not used
67	n-A	00	Not used
68	n-A	00	Not used
69	n-A	00	Not used
70	PF	00	Return time of the protective filter (Not used at present)
71	SSt	50	Waiting time for the safety shutter value × (10msec)
72	Ast	50	Waiting time for the aiming shutter value × (10msec)
73	n-A	10	Not used
74	n-A	10	Not used
75	n-A	00	Not used
76	n-A	00	Not used
77	n-A	00	Not used
78	n-A	00	Not used
79	n-A	00	Not used
80	n-A	100	Not used
81	n-A	100	Not used
82	n-A	100	Not used
83	n-A	100	Not used
84	n-A	100	Not used
85	n-A	100	Not used

Address	Abbreviation	Initial setting	Details
86	n-A	100	Not used
87	n-A	100	Not used
88	n-A	100	Not used
89	n-A	100	Not used
90	PuL	00	The number of pulses at automatic PFN adjustment (0: 4 pulses 1: 5 pulse)
91	Run	00	Not used
92	n-A	00	Not used
93	cnt	00	Setting for destination (Not used at present)
94	bSt	00	Burst (spare)
95	bno	03	Burst (spare)
96	bSP	250	Not used
97	n-A	00	Not used
98	PuP	00	Update of ROM
99	EEP	0	Initial setting of EEPROM 999: initial setting

§10 LIST OF PARTS TO BE PEPLACED

This section describes the list of parts to be replaced.

10.1 Consumables

Part No.	Name	Specifications
80402-02044	Fuse	6.3A 250V 5×20MM
80426-00015	Lamp	12V 30W

10.2 Parts to be repaired and replaced

Part No.	Name
13704-BA01	MASTER BOARD
13704-BA02	DISPLAY BOARD
13704-BA20	ILLUMINATION BOARD
13739-0000	MYLA Laser head
13739-E005	Trigger transformer
13733-BA01	POWER SUPPLY BOARD
13704-M037	Pinion
34348-M009	Rack
13704-M373	Plate
34135-M036	Shaft
34405-0000	Fixation lamp
80428-00003	Pilot lamp
80180-00034	Variable resister with switch (VR1)
13704-E020	SW power supply
13704-E111	Emergency stop switch
13704-1130	Focus ASSY
13704-1120	YAG shutter ASSY
13704-1220	Aiming shutter ASSY
13704-1300	Control board ASSY
13704-1400	Display board ASSY
13704-EA05	MASTER BOARD ASSY
13704-EA15	YL CABLE ASSY
13704-EA20	ILLUMI ASSY

§11 TOOLS, MEASUREMENT TOOLS, SOLVENT AND JIGS

11.1 Tools

(1) Phillips screwdriver set
(2) Flatblade screwdriver set
(3) Precise screwdriver set
(4) Hex. wrench set (mm)
(5) Hex. wrench set (inch)
(6) Hexagon socket screw key set
(7) Needle nose wrench
(8) Nipper
(9) Forceps
(10) Soldering iron
(11) Solder removal
(12) Cleaner for iron
(13) Blower brush
(14) Scissors

11.2 Measurement device

(1) Energy meter MODEL-365, MODEL PHDX50, Vector S 200 (For YAG laser)
(2) Power meter COHERENT MODEL212 (For aiming beam)
(3) Digital multi meter FLUKE 79
(4) Oscilloscope

11.3 Solvent

(1) Mixed solvent of alcohol (Methanol 50% + Ether 50%)

11.4 Jigs

Jig for adjustment of the LD optical axis	YCMJ-11 M029, M030
Power supply for SL adjustment	SL5CT-1L, M7177
Dioptric telescope	LIJ-4 G20
Disk plate	SL-1 J1, SLIJ-1 M011
Reticle	SLMJ-9 1000
Standard eyepiece	SL4EP-10D
Arm for aiming beam	YCMJ-4
Jig for the YAG optical axis	YCMJ-11 M024, M025, M026
Jig for focal point	YCZ-30 M001, M002, M003
Dispersion lens	YCZ-30 G001
Jig for aging	80452-01013
Goggle for the YAG laser	YL-300
Digital printer	DPU-411
Conductive wrist band	2314
Stand for the YC energy meter	YCMJ-3 2000

11.5 Others

Lens cleaning paper